MILL SECTION of Concrete

The Mill Edition of CONCRETE is edited for the manufacturers of portland cement, lime and similar products. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition.

The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

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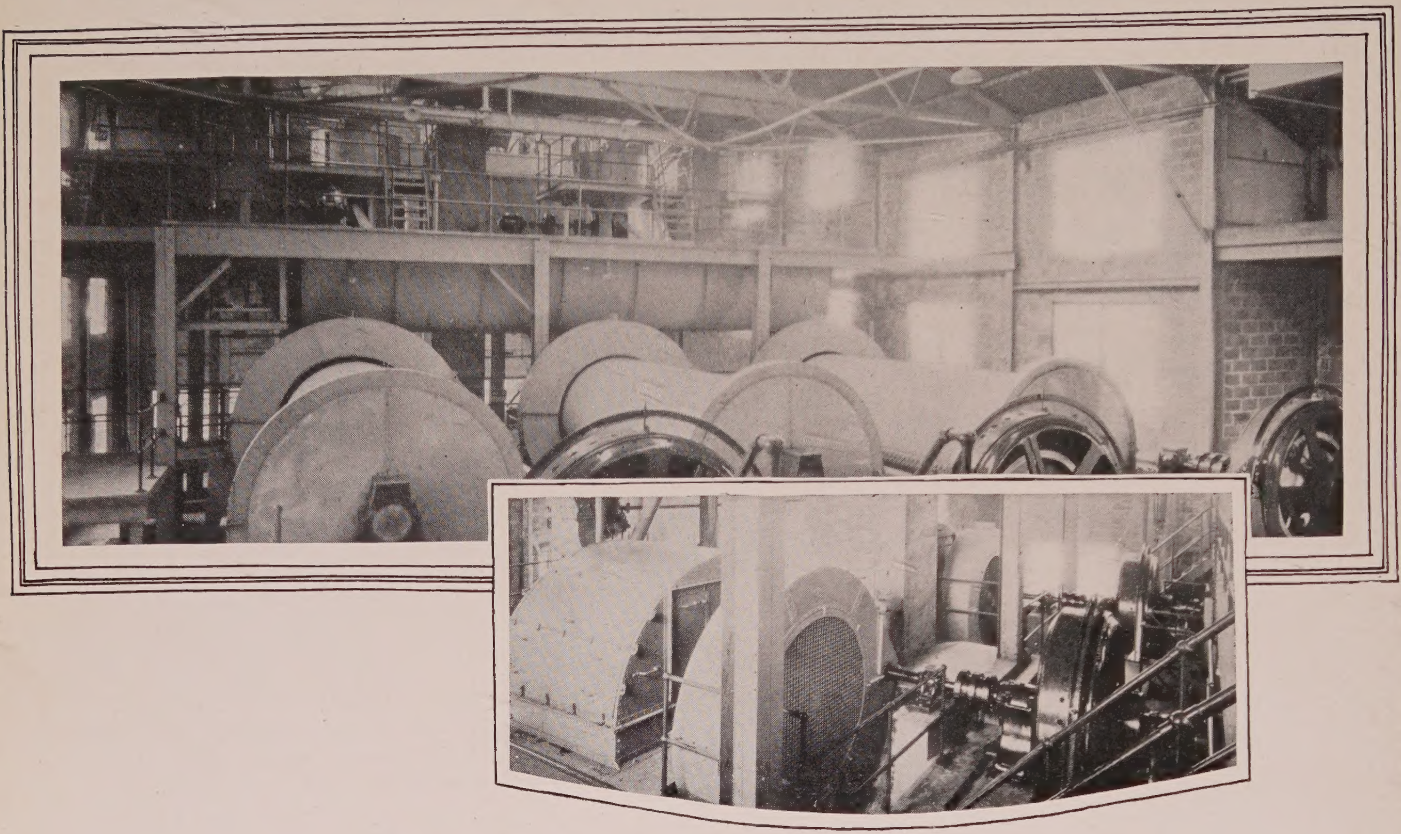
LARGE WET UNITS



The **WET KOMINUTER** takes run of crusher or hammer mill material, reducing it to a uniform size ideal for tubemill feed.

The **TUBEMILL** takes kominuter product, reducing it to a uniform fineness, which in the cement industry is so essential for good kiln feed.

The greatest wear on the Kominuter and Tubemill falls on cheap and easily accessible parts. In addition, they are not liable to damage from scrap iron, steel or other foreign materials.

Both Kominuter and Tubemill embody the benefit of experience gained from constant contact with grinding problems over a period of thirty years. The Kominuter and Tubemill form an ideal combination for the grinding and pulverizing of all refractory materials.

Kominuter and Tubemill Batteries combine flexibility of operation, uniform fineness of product, large capacity per horse power, low operating and maintenance costs.

F. L. Smidth & Co., Inc.

ENGINEERS

50 Church Street

Designers and Equippers of
Cement Making Factories

New York City

Factory, Foundry and Laboratory—Elizabeth, N. J.

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MILL SECTION of

Concrete

Vol. 30 January, 1927 No. 1

Closing the Gap

THIS year will see a wider margin between manufacturing capacity and sales than the cement industry has ever experienced. With an estimated production capacity of nearly 215,000,000 barrels for 1927 and predicted sales running equal to, or only slightly greater than, the 1926 volume, the industry is facing a new sales problem.

Yet that margin between capacity and sales, even if only 165,000,000 barrels are sold in 1927, is not extreme compared to that of other industries. A record of sales totaling 70 per cent of production capacity is not an unfavorable condition in the light of the experiences of other industries. It is only one of the conditions that all business enterprises must face.

A real sales effort will be necessary in 1927 to close the gap between capacity and sales. Competing materials interests have learned a lesson from the cement industry and are making plans to promote their products more energetically than ever before. The question is being raised whether or not concrete construction is entering fields in which other materials are claimed to be more suitable.

Increased efforts in bringing the advantages of concrete construction before builders will bring increased use of cement. It is to the interest of the industry to enlist every aid possible. Close co-operation with related industries, such as equipment manufacturers, reinforcing steel distributors, and perhaps the lime and admixture manufacturers, will multiply the effectiveness of the work.

For, after all, are not these industries striving toward the same end that the cement industry is working for? Equipment men are, or should be, constantly striving to lift the concrete industry to a higher plane and to enlarge its scope. The sale of reinforcing steel depends directly on the volume of reinforced concrete construction awarded. The use of lime and admixtures depends, in a measure at least, on the volume of concrete placed.

Is it not reasonable to suppose that the interests of these industries are identical with those of the cement industry? None of them have aims that cannot be considered as compatible with those of the cement industry. Lime and admixture men should know and admit that good concrete can be made without the use of their products. Yet, if their inclusion adds a factor of safety in the quality of the concrete, then it may be an advantage to encourage them under the field conditions and practices found on the average concrete job.

Whole-hearted co-operation with these related industries may result in a unified plan of procedure that could be of real help to the cement industry in closing the gap between production and sales.

Equipment Facts

COMPARATIVELY little material has been published giving accurate analytical data on the performances of equipment in cement mills, even though such material is of inestimable value to the cement mill operator.

The series of articles by R. R. Coghlan and T. H. Arnold, now being published in the Mill Section is an example of this type of research. Careful observance of the changes in the behavior of the various units of equipment under varying conditions together with studies into the reasons for these changes have resulted in the compilation of data that will be of very great value to cement mill operators.

There are any number of other viewpoints and other types of equipment from which new data on design and performance could be collected. Many engineers are content to take things as they are instead of searching and researching until they have unearthed principles and facts that are worthwhile contributions to the knowledge of cement manufacture.

In a field where so little research has been completed along the lines of equipment performance, there is much opportunity for the mill executive to distinguish himself and to be of outstanding benefit to the industry.

Two of England's Modern Cement Plants

A Detailed Description of the Methods and Equipment Used in Two of England's Newest Cement Plants—History of Cement Manufacture in England—Remodeling the Bevans Works of the Associated Portland Cement Manufacturers, Ltd.—A Description of the New Kent Works—Pump Raw Materials from Pit to Plant

By A. C. BLACKALL

Part I

UNDOUBTEDLY the development of concrete construction during the first quarter of the present century marks one of the most noteworthy periods in modern engineering history. Last century the material, although satisfying a long-felt want, was disliked even by a Victorian public in England. Builders, architects and engineers, bowing before popular prejudice, hesitated to give it recognition unless actually compelled to do so by force of structural circumstances. To that era the term "concrete" practically became synonymous with ugliness and commercialism.

Portland cement concrete continued to be regarded unfavorably in the United Kingdom for the best part of a century after its discovery. Its comparatively recent acceptance as an indispensable factor in construction is therefore all the more striking.

The enormous strides that concrete has lately made in Britain are absolutely bewildering, and the records of the Patent Office in London are heavy with the labor of innumerable inventors working in this direction. Concrete construction is now to be seen everywhere throughout Great Britain, and has shown itself of inestimable value to the community.

The history of portland cement must forever be linked inseparably with that of the River Thames. By a singularly fortunate combination of circumstances the Thames had not only a political geography which made it the world's most important waterway, but it also had a physical geography which, when the invention of the steam engine seemed likely to develop rival ports at the expense of that of London, could provide the clay and chalk required in the manufacture of the new material destined to alter the entire manner of constructional work. Favored with such natural conditions, the Thames and Medway Rivers and the surrounding district proved a cradle for the industry.

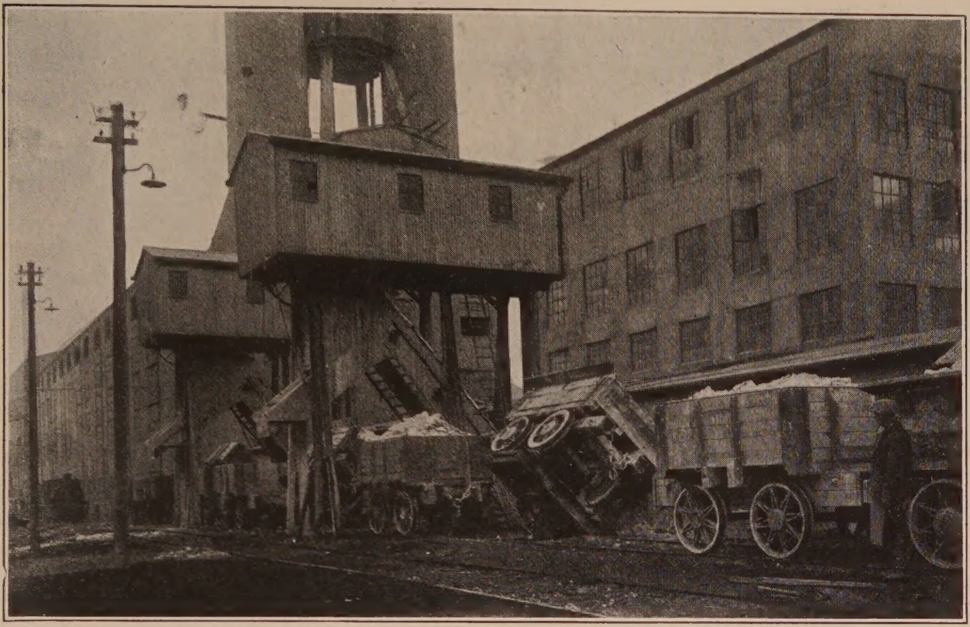
Cement Marketing Co., Ltd.

Here the Blue Circle cement products are manufactured, this symbol being the trade mark adopted by the Cement Marketing Co., Ltd., to identify its material. One is rarely away from this symbol in the estuary of the Thames. Scows showing this sign on their topsails now form one of the most conspicuous features of London shipping. The latest manufacturing development of this concern is the evolution of ferrocrete, the new rapid-hardening portland cement. Ferrocrete fulfills the need for a cement

Steam shovel operating in the chalk pit of the Kent Works that will attain a high strength at an early age, giving in four days the full strength of concrete made with ordinary portland cement 28 days old. The saving of time and consequently of money by the use of ferrocrete varies in almost every form of constructional work, but it is claimed to be substantial in every case.

It is made at Bevans Works, Northfleet, which is claimed to be the most ancient and at the same time the most modern portland cement works in the world. Kilns recently discovered have revealed that even during the Roman occupation of Britain there existed a chalk-burning industry on the identical site.

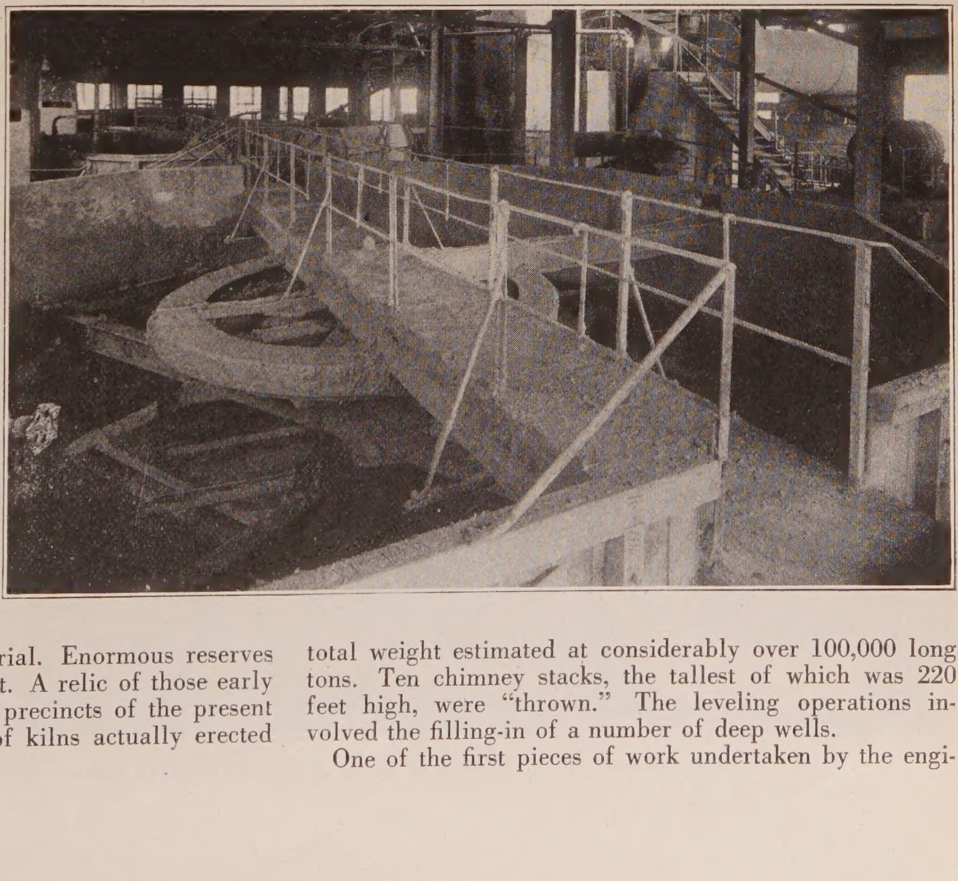
When Joseph Aspdin discovered his famous process for the making of portland cement in 1824, the geological position of Bevans was quickly realized to be ideal for the manufacture of the new material. Enormous reserves of chalk and clay were on the spot. A relic of those early days is still preserved within the precincts of the present modern works. This is the line of kilns actually erected by the Aspdin family.



Tipping chalk and clay into the washmills

Rebuilding the Bevan's Works

In 1924 — the centenary of Aspdin's discovery — the directors of the Associated Portland Cement Manufacturers, Ltd., embarked on a great reconstruction scheme at the Bevans works. Methods since the war had changed greatly, and it was decided to scrap practically all the old buildings and plant and thus thoroughly modernize Bevans. Such reconstruction would also ensure a far greater output than that from any other portland cement works in Europe. This increased production had become vitally necessary in order to meet the ever-growing activity in the trade, and the scheme was carried through as rapidly as possible. More than 600 men were engaged continuously on day and night shifts. The demolition work included the removal of machinery, hardcore, bricks, etc., of a total weight estimated at considerably over 100,000 long tons. Ten chimney stacks, the tallest of which was 220 feet high, were "thrown." The leveling operations involved the filling-in of a number of deep wells.



The preliminary washmills at the Kent works

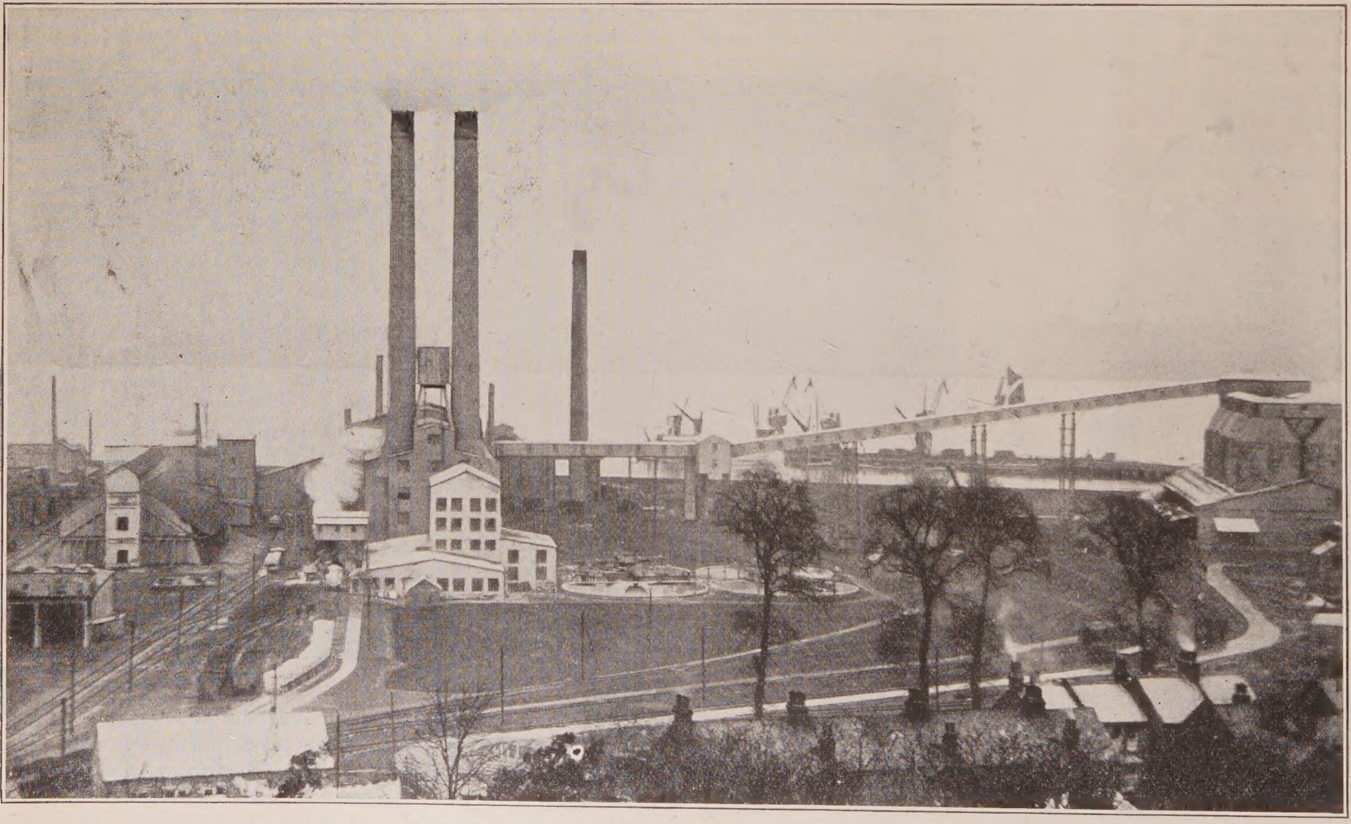
One of the first pieces of work undertaken by the engineers was the construction of a strong, inclined railway in order to facilitate the transport of heavy plant and machinery. This led from the old telpher dock, and carried up the new rotary kilns—the largest in Europe.

Included in the construction program was the erection of new wash mills, clay mixers, storage silos and new grinding mills. A mile of slurry main was laid from the wash mills to the mixers, and a new concrete jetty was also built. The latter is 600 feet in length and has a spring-tide low water depth of 26 feet. It is supported by concrete piles 60 feet in length and 18 inches square, reinforced and made of ferrocrete cement. Ocean-going vessels of up to 8,000 tons register are able to berth at any state of the tide.

Raw Materials

Clay is broken down at the clay pits in the nearby Swanscombe Woods, and pumped through a pipe-line 1½ miles in length to storage, when it is conveyed by gravitation into wash mills. These are located near a great chalk hill—still under cultivation—which in time will be quarried by steam shovel at the rate of 150 tons per hour. By means of special elevators the trucks conveying the chalk can be lifted bodily and tipped over the top of the wash mills, flints being removed from the bottom of the mills direct into other trucks. The slurry, during its passage through the wash mills, is brought to such a fineness that the residue on a 180-mesh sieve does not exceed three per cent. It is then pumped through 8-inch steel pipes to

Slurry mixing and storage tanks



General view of the Kent works of the Associated Portland Cement Manufacturers, Ltd.

six storage mixers. These are each 66 feet in diameter and 11 feet in depth, having a capacity for sufficient slurry to produce 500 tons of clinker.

This slurry is fed to the rotary kilns in absolutely regular quantities. The kilns are of the most modern pattern and each is capable of producing 360 tons of clinker daily. Each is 250 feet in length, and the combined capacity of the four is twice that of the twelve old kilns which they have replaced.

After passing through the coolers, the clinker is conveyed to storage, and subsequently ground. The six grinding mills are of the compound type, and each is capable of producing 12 tons per hour—the cement leaving a residue of not more than 5 per cent on the 180 sieve.

From these mills the cement is driven into the storage silos with the aid of compressed air, subsequently being conveyed to the packing plant for shipment. Electric luffing cranes are used for this purpose.

The Kent Works

The Kent Works of the Associated Portland Cement Manufacturers, Ltd., is another most modern and up-to-date portland cement plant. It was constructed a few years earlier than the new Bevans Works—during 1919-21—and possesses a weekly output of 4,500 tons of portland cement, all of which more than meets the requirements laid down in the British Engineering Standards Specifications. It is termed the "show" works of the company, and possesses many features of interest to the visiting cement man.

One of the accompanying illustrations shows the quarrying of the chalk on the company's extensive properties adjacent to the Kent Works. Electric cranes on the jetty at this works unload the alluvial clay imported in scows from the River Medway.

The chalk and clay in 5-ton loads are discharged into the mills by hydraulic means, as another photograph illustrates, and mixed in definite proportions with about 43 per cent of water. The resulting slurry mixture, after passing through the preliminary wash mills (as illustrated), of which there are three, each 29 feet 6 inches in diameter, is put through the separators and finishing tube mills, and leaves these through a sieve having 32,400 holes per square inch. The chalk employed consists of practically pure carbonate of calcium, and the clay of silicates of alumina and fine quartz sand, the ratio of total silica to alumina being approximately 4 to 1. The mills deal with 100 tons of raw material hourly.

Mixing Tanks

So as to secure the utmost possible uniformity in the chemical composition of the slurry, it is passed from the finishing mills into four large mixing and storage tanks (as illustrated), each 66 feet in diameter and 11 feet in depth. In these tanks it is kept continually in motion by mechanical stirrers, and is finally pumped to the kilns. Each mixer holds a sufficient quantity of slurry to make 500 tons of clinker.

Under the modern manufacturing system the entire process of amalgamating the raw materials is under the direct control of the works chemist, who sees that the composition of the mixture is kept constant, thereby ensuring a perfectly uniform and sound cement.

In the second section of the manufacture the water present naturally in the raw materials and that added for mixing purposes is evaporated and the dry material thus obtained is gradually heated up to a temperature of approximately 2,800 degrees Fahrenheit, at which temperature the whole of the carbonic anhydride present in the chalk has been expelled, converting the chalk into lime, and the latter has entered into chemical combination with the silica and alumina of the clay, forming a double silicate of lime and alumina, which is the main constituent of portland cement clinker.

(Part 2 of this article will be published in the February issue)

1925 Hydrated Lime Shipments Show Increase

Domestic producers of hydrated lime shipped into the various states of continental United States 1,552,979 short tons of hydrated lime during 1925, according to statistics compiled by the Bureau of Mines, Department of Commerce. These figures show an increase of 18 per cent compared with corresponding figures for 1924. Of the total amount, 771,150 tons, or about one-half, was produced in Ohio. Since so large a part of the total shipments came from Ohio plants, the distribution of the Ohio product is compared with that of the United States as a whole in the table given below. Reshipment by dealers is not considered. Publication of comparative figures of shipments into individual states is not permissible as it would tend to disclose items relating to distribution by individuals. The figures below are therefore presented for seven blocks of contiguous states which roughly comprise various freight-rate groups:

	Shipped from All Plants to Ohio		Shipped from Ohio Plants to		
State Group[1]	Short Tons	Per Cent Distribution	Short Tons	Per Cent Distribution	Per Cent Group Total
1	450,555	29.0	365,249	47.0	81.1
2	613,701	39.5	261,273	33.6	42.6
3	54,819	3.5	21,717	2.8	39.6
4	172,432	11.1	71,395	9.2	41.4
5	68,271	4.4	22,833	2.9	33.4
6	141,286	9.1	33,496	4.3	23.7
7	51,915	3.4	1,301	.2	2.5
	1,552,979	100.0	777,264	100.0	50.05

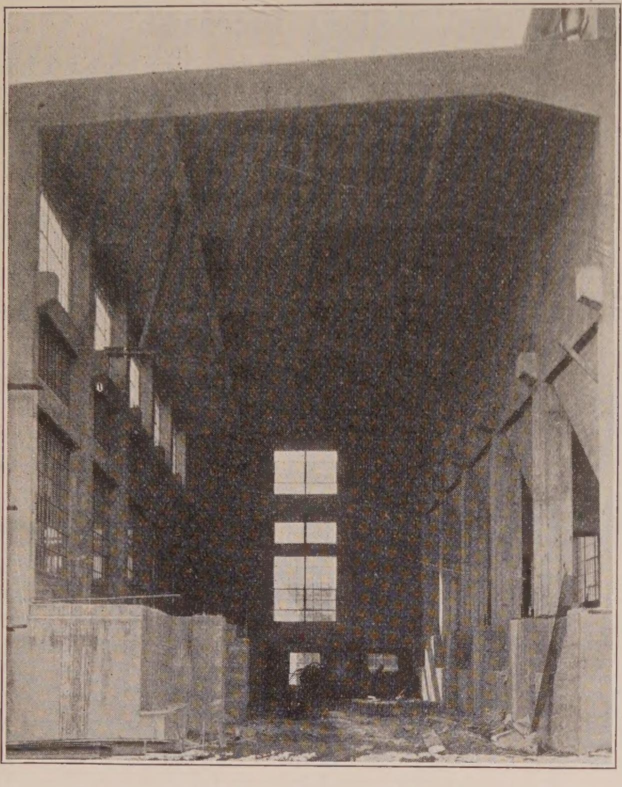
---

[1] 1. Ill., Ind., Mich., Ohio.
2. Del., Dist. of Col., Md., N. J., N. Y., Pa., W. Va.
3. Conn., Me., Mass., N. H., R. I., Vt.
4. Fla., Ga., N. C., S. C., Va.
5. Ala., Ky., La., Miss., Tenn.
6. Ark., Ia., Kans., Minn., Mo., Nebr., Okla., Tex., Wis.
7. Ariz., Calif., Colo., Idaho, Mont., Nev., N. Mex., N. Dak., Ore., S. Dak., Utah, Wash., Wyo.

Sack Test Results Disclosed by Bureau of Standards

Washington, D. C.—Investigation undertaken at the Bureau of Standards in co-operation with the Portland Cement Association demonstrates that a cement sack can be made of jute burlap that is superior in essentials to the cotton sack. The cement industry now spends $13,000,000 a year for cotton osnaburg sacks and if it adopts the burlap sack will realize a saving of $3,000,000, according to an announcement by the Bureau. The tests made of burlap sacks included breaking strength, thread count, length, width, stretch, and failure from dropping or rough handling. Finally practical tests were made on the sacks which made the best showing, by filling the sacks with hot, freshly ground cement after they were given a humidity test by exposing the filled bags to various atmospheric conditions, including excessively damp conditions.

Construction Views of the Boettcher Plant of the Colorado Portland Cement Company



The grinding mill building. The foundations for the 5 three-compartment grinding mills and the 600-h.p. motors are completed.

◆

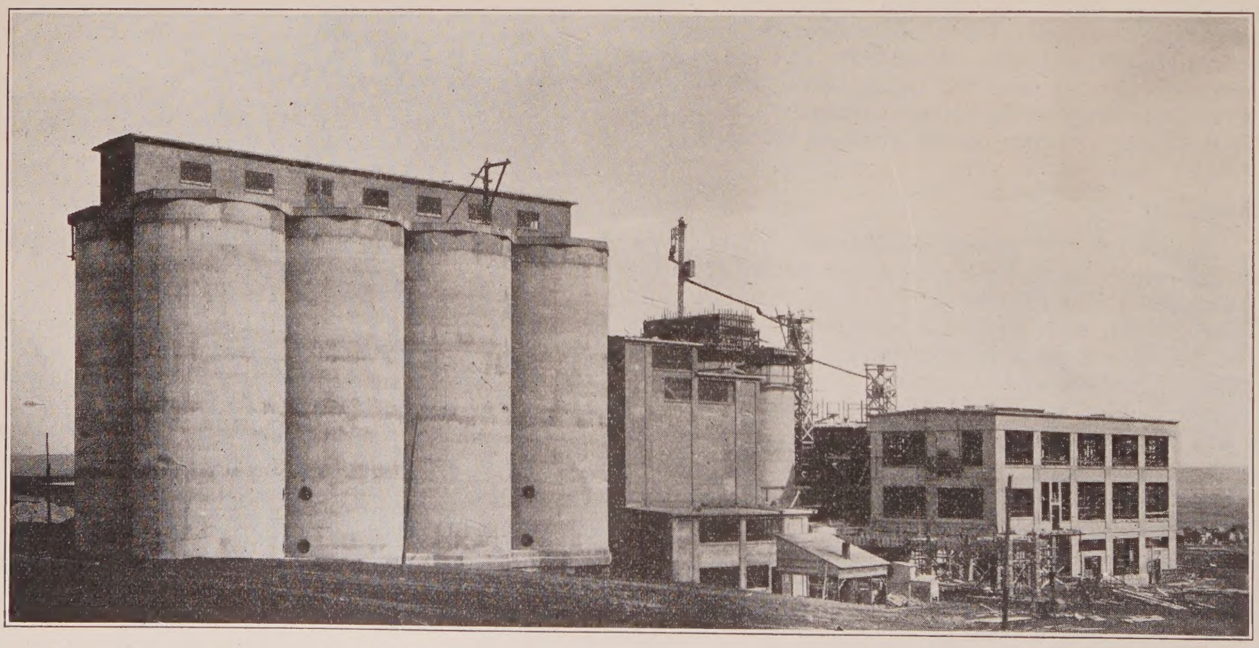
In the December Mill Section a description and a layout of the new plant of the Colorado Portland Cement Company at Boettcher, Colo., were published.

In this issue additional illustrations of the plant, as the buildings near completion, are presented.

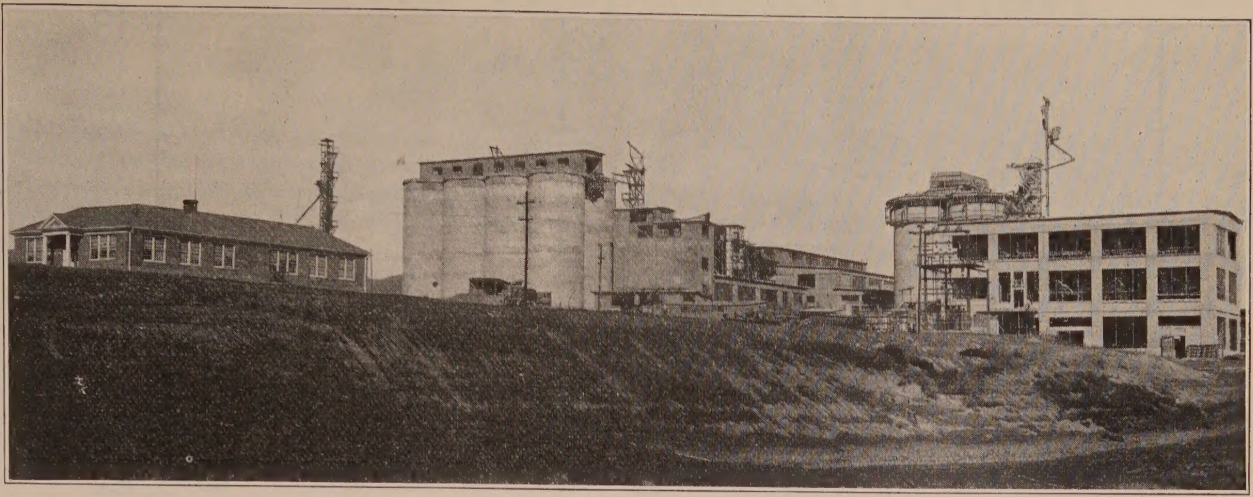
The new plant will have a capacity of 3,600 barrels per day. It is located about 7½ miles from Fort Collins, Colo., and about 70 miles north of Denver.

Paul C. Van Zandt, Chief Engineer of the Ideal Cement Company, the holding company, is in charge of construction.

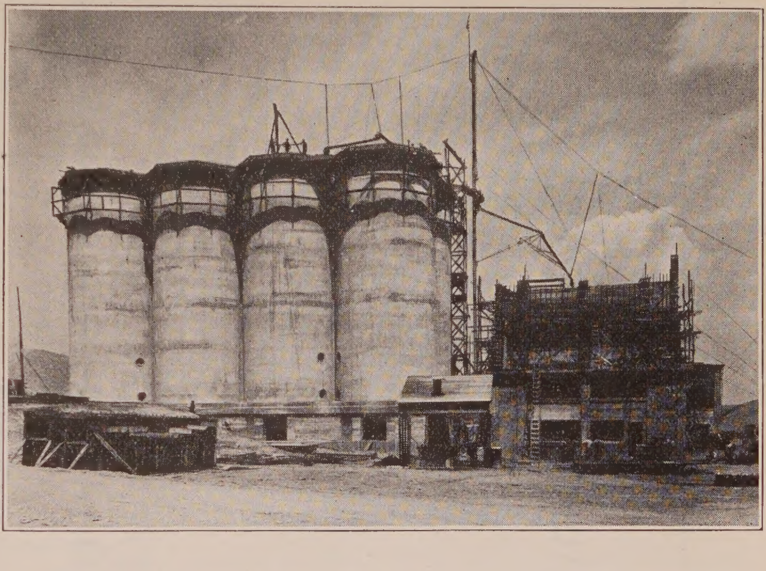
◆



The rock storage bins are shown on the left and the power house on the right. Between them is the dryer building



A general view of the plant, showing the plant office at the left.

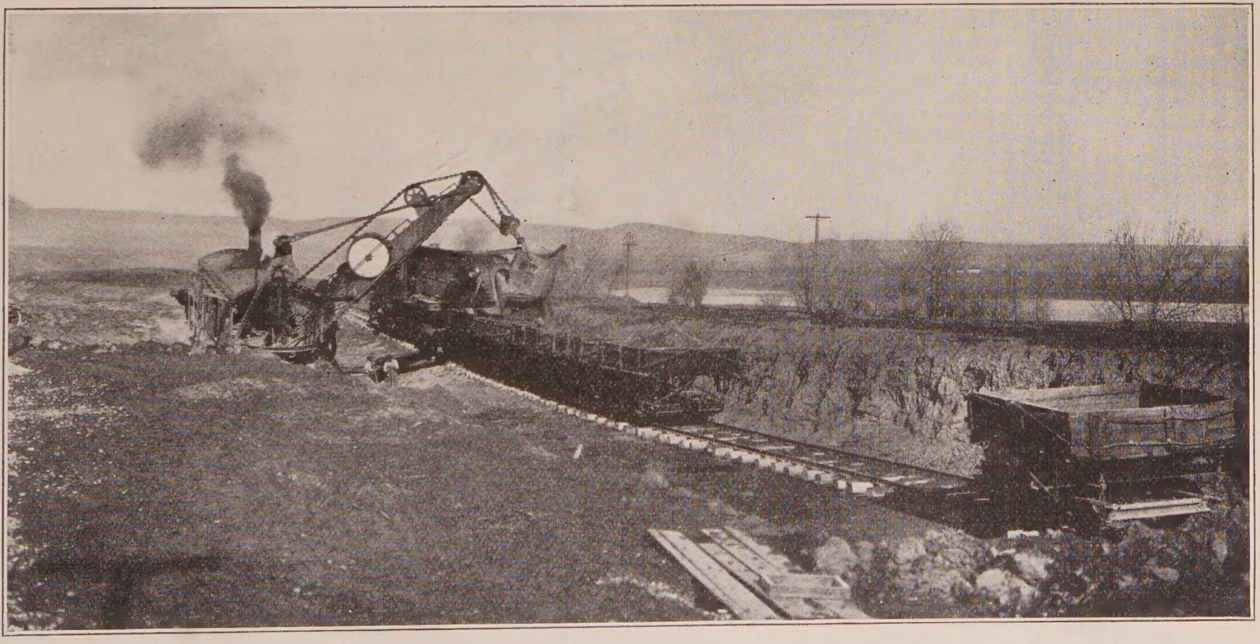


⁂

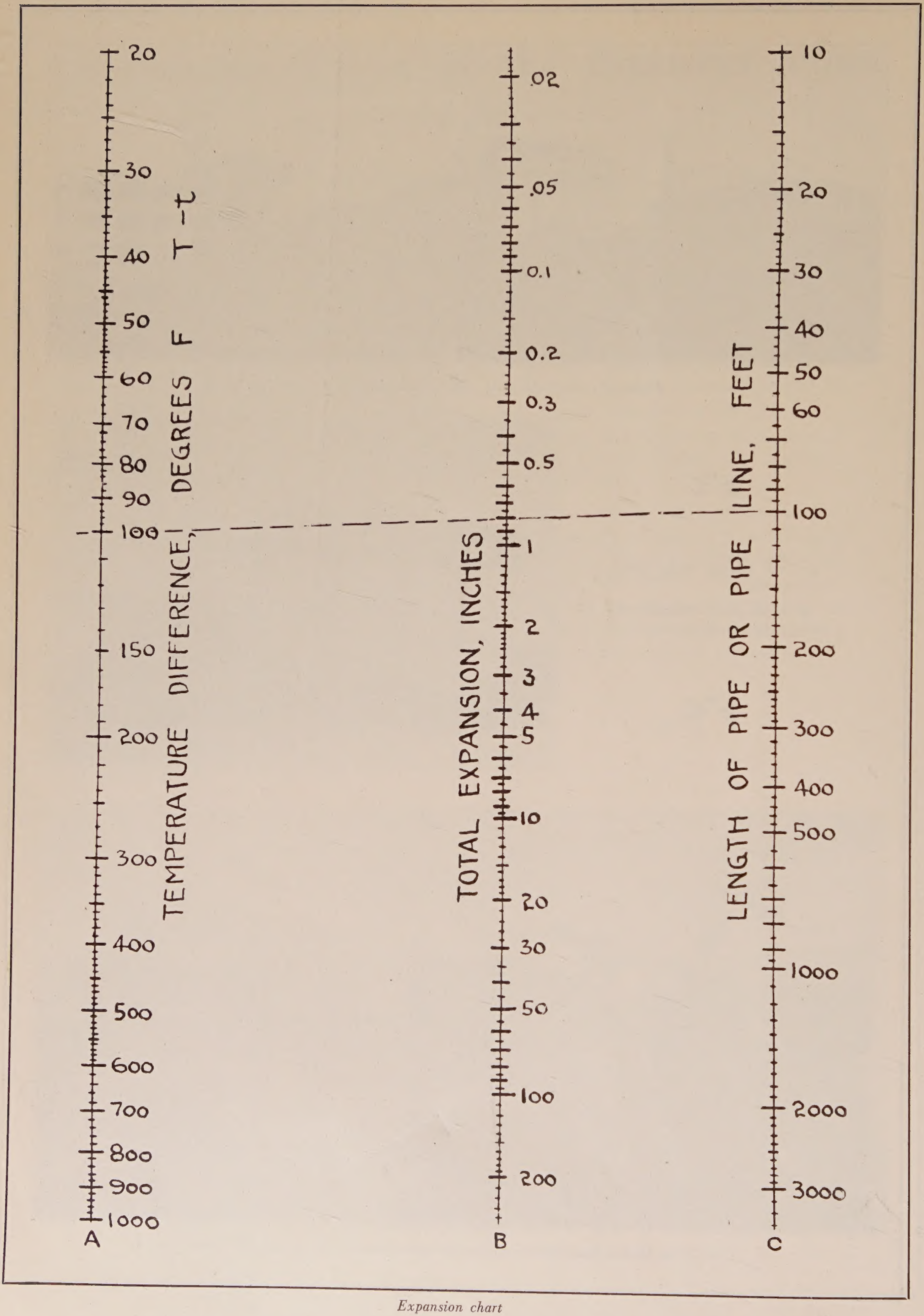
The rock storage tanks under construction.

All of the plant structures are built of reinforced concrete.

⁂



A Model 70 Marion steam shovel making the excavation for the storage bin foundations.



Expansion chart

A Useful Expansion Chart

By W. F. SCHAPHORST, M.E.

MILL engineers and officials will find the chart appearing on the opposite page useful for determining the expansion to be allowed in piping, rods, tubes, etc., for various temperature differences. This chart makes "longhand figuring" unnecessary.

To use the chart simply lay a straight-edge across it once or stretch a fine black thread across, as indicated by the dotted line and the problem is solved without further ado.

For example, a certain pipe line is installed which is 100 feet long. It will be subjected to a temperature variation of 100 deg. Fahr. What will be the total expansion in inches?

Connect the 100-deg. temperature difference, Column A, with the 100-foot length, Column C. The intersection with Column B gives the answer as 0.8 inch. That's all there is to it.

Inversely the chart can be used for determining the allowable temperature difference where a definite amount of space is available for expansion and contraction. Thus if the length of the pipe is 100 ft. and the allowable expansion is 0.8 inches, the same line would show that a temperature difference of 100 deg. Fahr. would be the limiting amount.

Also, if the factors in Columns A and B are known, the unknown in Column C is immediately found. In other words, if any two of the factors are known the third is very quickly found, and without any computing whatever.

It will be noted that the range of the chart is wide enough to take care of almost any expansion or contraction problem that the engineer may have to contend with. The temperature difference, Column A, varies all the way from 20 deg. to 1,000 deg. It is very seldom, if ever, that we have as high a temperature as 1,000 deg. The length of pipe line, also, is great, varying all the way from 10 to 3,000 feet, or more than half of one mile. And the total expansion between these limits varies all the way from 0.02 inch to 200 inches. It is interesting to note that if we had a pipe line 3,000 feet long, with a temperature difference of 1,000 deg., the expansion would be over 200 inches.

Study of Labor Productivity Gives Cement Industry High Rating

A study of the productivity of labor by the Bureau of Labor Statistics, Department of Labor, reveals that of the four industries investigated, cement manufacturing shows the greatest increase in productivity, the output per man hour having increased 57.8 per cent between 1914 and 1925. The other industries covered in the bureau's study were flour, leather and sugar refining.

The number of men employed in the portland cement industry remained practically constant at about 30,000 in 1914, 1919 and 1921, as reported in the Census of Manufactures, but coincident with the great increase in production beginning in 1922, the number increased rapidly to around 40,000 in 1923, where it has remained since then.

Quoting census reports, the Bureau states that the average full-time hours per week for all workers in the industry were as follows: 1913, 63¾; 1919, 61; 1921, 60¾; and 1923, 60¼.

"The actual reduction in hours may have been somewhat greater than this," the report continues. "When it is noted that about 66 per cent of all the wage earners were listed as working 'over 60' hours per week in 1914, over 40 per cent so listed in 1919, nearly 40 per cent in 1921, and almost 37 per cent in 1923, it becomes evident that reductions in hours, such as from 72 to 66, while it would mean a pronounced reduction in the average hours of labor in the industry, would have no effect at all on the above averages, since the evidence of the change would not appear in the census figures. Therefore, it is not claimed that the index of full-time hours per week in the cement industry is substantially accurate although it may possibly be very accurate. Besides, there are two other points to be taken into consideration:

"(1) The salaried employes work longer hours than the other men where the 8-hour shift exists for the men engaged in the continuous operations, and shorter hours than the men employed on 12-hour or 11- and 13-hour shifts. Since the salaried employes constitute between 13 per cent and 16 per cent of the total working force, this might be of some importance in the final average.

"(2) There are no data at all on the subject of actual hours worked per week, as distinguished from the standard full-time hours. There is no material on over-time, part time, absences, turnover, etc., which at times vary so much as to prevent the standard hours from being a good indication of the amount of work performed.

"With these limitations in mind, the index of full-time hours can be multiplied by the index of men employed to get an index of man-hours for the industry; and despite the gaps in the data outlined above, it is probable that the resulting index of man-hours is fairly accurate.

"The final step consists in dividing the index of production by the index of man-hours to get the productivity. This is shown in the table below:

INDEX OF PRODUCTIVITY IN THE CEMENT INDUSTRY

Year	Production Index	Employment Index	Productivity
1914	100.0	100.0	100.0
1919	91.1	89.7	101.6
1921	111.4	92.1	121.0
1923	155.7	120.0	129.8
1924	168.7	119.8	140.8
1925	182.8	115.9	157.8

"Production figures not given in the above table, show that the output in 1916 and 1917 was larger than in 1914, but in 1918 the production index fell to 80, from which point it increased to 91 in 1919. Despite this great falling off in production there was no decrease in productivity, which is rather surprising, for usually the reduction in employment does not keep pace with the reduction in output. It is quite natural, however, that the great expansion in output in recent years should not require a proportionate amount of man-hours. Under ordinary conditions very few plants in an industry are working to capacity throughout the year, and most industries are over-equipped in the sense that it is possible to expand production considerably with very little addition of men or equipment. Giving this point all due consideration, however, the increased output is still quite remarkable. It can be partly accounted for by the installation of larger and better machinery, and the tapping of good mines."

Power Plant and Kiln Design and Operation

A Series of Articles on the Combined Processes of Power Plant and Kiln Operation Considered as a Unit

By R. R. COGHLAN
Chemical Engineer
AND
T. H. ARNOLD
Electrical Engineer, Southwestern Portland Cement Company, Osborn, Ohio

Chapter IV.—Calculation of Heat Distribution in Kilns, Waste Heat Boilers and Flues

Presenting a Method of Checking Operating Results from Waste Heat Boilers and Kilns—Charts, Tables and Formulae to Facilitate Computations—Calculating Air Required for Combustion—Raw Material Gases and Their Analysis—Heat Absorption—Heat Calculations—Comparison with Direct Fired Boilers

NO comprehensive method has been advanced for accurately checking the operating results obtained from waste heat boilers and kilns which offers a heat balance comparison similar to the standard methods of testing direct-fired boilers.

The following method is offered as the result of a number of tests on the combined results from cement kilns with waste heat boilers operated in conjunction with them. No originality is claimed for the methods of calculation. By a process of substitution and elimination a series of standard methods of calculation has been applied to the solution of the problem which will give accurate results in a logical manner.

From the nature of the problem it is evident that the calculation of heat distribution in a waste heat boiler system will be somewhat more involved than a similar calculation for a direct fired boiler test. It is desirable that the period of test be rather long to avoid errors in measurement of quantities. Under favorable conditions a period of 24 hours may be sufficient, although a longer period will give more accurate results. Cross checks may be applied to eliminate a portion of the errors in quantities.

The following quantities should be observed during the entire period of the test:

- Weight, average ultimate analysis, and average heating value of the dry coal.
- Weight, average analysis, and moisture content of the raw material.
- Average temperature and analysis of the gases at the kiln exit and the economizer exit.
- Average temperature and humidity of the air used for burning.
- Weight and average temperature of the water fed to the economizers.
- Weight, average temperature and pressure of the steam from the boilers.

Heat Content of Gases

In general boiler practice, the mean specific heat of the gases is used because the composition of the gases will not vary widely except for the admission of excess air. In waste heat practice, this will result in considerable inaccuracy owing to the high moisture content and the wide variation in the composition of the gases. Thus, to obtain a reasonable degree of accuracy, the individual specific heats of the component gases at the various temperatures must be used. The additional calculation will be justified by the discrepancies eliminated.

The gases commonly encountered in waste heat work are water vapor, carbon dioxide, oxygen, carbon monoxide, nitrogen, and sulfur dioxide. The B.t.u. per pound of these gases at various temperatures Fahrenheit are expressed by the following formulae:

TABLE I

B.t.u. per pound of the constituent gases formed by combustion

Temp. of gas in deg. F.	Water vapor	Carbon dioxide	Oxygen	Nitrogen and carbon monoxide	Sulfur dioxide
50	21.26	9.65	10.5	12.1	6.4
100	43.03	19.6	21.1	24.2	13.1
200	88.12	40.4	42.5	48.6	27.4
300	135.27	62.4	64.1	73.2	43.0
400	184.48	85.6	85.8	98.1	59.8
500	235.75	110.0	107.8	123.2	77.8
600	289.08	135.6	130.0	148.6	97.0
700	344.47	161.0	152.4	174.2	117.4
800	401.92	190.4	175.0	200.0	139.1
900	461.43	219.6	197.8	226.1	161.9
1000	523.00	250.0	220.8	252.4	186.1
1100	586.63	281.6	144.0	278.9	211.4
1200	652.32	314.4	267.5	305.7	237.9
1300	720.07	348.4	291.1	332.8	265.7
1400	789.88	383.6	314.9	360.0	294.7
1500	861.75	420.0	339.0	387.5	324.9
1600	935.68	457.6	363.3	415.2	356.4
1700	1011.67	496.4	387.7	443.2	389.0
1800	1089.72	536.4	412.2	471.5	422.9
1900	1169.83	577.6	437.3	499.9	458.0
2000	1252.00	620.0	462.4	528.6	494.4
2100	1336.02	663.6	487.7	557.5	531.9
2200	1422.52	708.4	513.2	586.7	570.7
2300	1510.87	754.4	538.9	616.1	610.7
2400	1601.28	801.6	564.9	645.7	651.9
2500	1693.75	850.0	591.0	675.6	694.3
2600	1788.28	899.6	617.3	705.7	738.0
2700	1884.87	950.4	643.9	736.1	782.9
2800	1983.52	1002.4	670.7	766.7	829.0
2900	2084.23	1055.6	697.6	797.5	876.3
3000	2187.00	1110.0	724.8	828.6	924.9

Several formulae have been given by various experimenters for the instantaneous heat content of the gases with varying temperatures. The formula of Richards, converted to English units will give results which are within the errors of observation in boiler testing and these formula have been adopted for this discussion.

B.t.u. per pound for:
Water vapor = $t(.42 + .000103t)$
Carbon dioxide = $t(.19 + .00006t)$
Oxygen = $t(.2104 + .0000104t)$
Carbon monoxide and nitrogen = $t(.2405 + .0000119t)$
Sulfur dioxide = $t(.125 + .0000611t)$

Use of Chart and Table I

To reduce the amount of calculation in the solution of the individual problems, Table I and Chart I have been prepared showing the B.t.u. per pound of the various gases over a range of 50 to 3000 deg. F., which will cover the field of waste heat gases. It will be noted that the values given are for water vapor and do not include the latent heat of evaporation. The chart reveals a wide variation in the characteristics of the various gases and brings out very prominently the value of a high carbon dioxide content. As compared with oxygen, carbon dioxide at 1500 deg. F. has 81 B.t.u. more per pound in the inlet gas to the boiler while at 400 deg. F. the outlet gas from the economizer has .2 B.t.u. less per pound than oxygen. As compared with nitrogen the inlet gas has 32.5 B.t.u. more per pound and the outlet gas 12.5 B.t.u. less per pound. This in part explains the losses from air infiltration and the reason for high heat recovery with high CO_2 values. For convenience in reading, the lower values of the curves are shown on an enlarged scale in the upper portion of the chart.

As an example of the use of this chart the following problem is given:

Find the heat content in B.t.u. per pound of the following gas at 1240 deg. F.—

Constituent	Per cent by weight	Lbs. per lb. of gas		B.t.u. per lb. from chart	B.t.u. per lb. of gas
CO_2	24.9	.249	×	327	81.42
O_2	3.1	.031	×	277	8.59
N_2	56.0	.560	×	316	176.96
H_2O	16.0	.160	×	680	108.80
					375.77

Thus 375.77 × the pounds of gas per hour = heat available per hour.

The following problem has been prepared to illustrate the method of calculating the results of a complete boiler and kiln test with a heat balance for the system. The observed results are as follows:

Average Analysis of raw mix

	Per cent
SiO_2	12.67
R_2O_3	4.35
CaO	40.99
MgO	3.35
CO_2	35.89
H_2O	1.00
	98.25

Average Analysis of Coal

	Per cent
C_2	67.00
H_2	4.35
O_2	7.15
N_2	1.40
S_2	.40
Ash	19.70
	100.00

Per cent water in slurry = 36.3 per cent.

B.t.u. per pound = 11,965.

Pounds of dry coal burned per hour	7,150
Pounds of dry raw mix per hour	31,633
Pounds of water in slurry per hour	18,033
Barrels of clinker burned per hour	54.6
Temperature of air for burning, deg. F.	80
Humidity of air, per cent	55
Average temp. of gases at kiln exit, deg. F.	1,229
Average temp. of gases at economizer exit, deg. F.	360
Average steam pressure, pounds gage	204
Average steam temperature, deg. F.	491
Average temperature of water to economizers	182
Pounds of steam delivered by boilers per hour	24,091
Pounds of steam for blow down, pop, and soot blowers	3,082
Pounds of feed water to boilers per hour	27,173

	Per cent by volume			
	CO_2	O_2	CO	N_2
Average gas analysis at kiln exit	21.28	4.07	.07	74.58
Average gas analysis at economizer exit	19.61	5.97	.10	74.32

Heat Absorption

The usual methods for calculating the heat absorbed by the boilers and economizers in direct-fired practice are used for determining the heat absorbed in the steam generated. With water delivered to the economizers at 182 deg. F. and raised to steam at 204 pounds gage and 491 deg. F., the steam tables give the heat content of the steam as 1259.6 B.t.u. per pound and the water as 149.9 B.t.u. per pound.

The factor of evaporation is then:

$$\text{F. E.} = \frac{1259.6 - 149.9}{970.4} = 1.1432$$

The equivalent evaporation from and at 212 deg. F. is: equiv. evap. = 27,173 pounds × 1.1432=31,031 pounds.

The boiler horsepower developed is:

$$\text{B. H. P.} = \frac{31{,}031}{34.5} = 899.4$$

The B.t.u. absorbed per hour by the boilers and economizers is:

$$\text{B.t.u.} = 31{,}031 \times 970.4 = 30{,}112{,}482$$

Air Required

The calculation of the combustion in the kilns begins with the calculation of the weight of air required to burn one pound of coal as fired.

Weight in 1 pound of coal		Weight of air required, pounds O_2	
C_2	$.67 \times \frac{32}{12} =$	1.7880	for combustion of carbon.
H_2	$.0435 \times \frac{32}{4} =$	.3480	for combustion of hydrogen.
S_2	$.0040 \times \frac{32}{32} =$	.0040	for combustion of sulfur.
		2.1400	for combust'n of 1 lb. of coal.
	Less	.0715	in coal.
		2.0685	required from air.

$$\frac{2.0685}{.231} = 8.9537$$ pounds of air per pound of coal.

$8.9537 \times .231 = 2.0685$ pounds O_2 per pound of coal.
$8.9537 \times .769 = 6.8852$ pounds N_2 per pound of coal.

The weight of gas produced by the combustion of one pound of coal will be:

$CO_2 = 1.7880 + .67$ 2.4580
$H_2O = .0435 + .3480$ .... .3915
$N_2 = 6.8852 + .0140$ 6.8892
$SO_2 = .0040 + .0040$ .... .0080

Pounds of gas per pound of coal 9.7567

The weight of the gases produced per hour by the combustion of 7,150 pounds of coal per hour with perfect combustion, will be:

$CO_2 = 7150 \times 2.4580 = 17{,}575$ pounds
$N_2 = 7150 \times 6.8992 = 49{,}329$ pounds
$SO_2 = 7150 \times .0080 = 57$ pounds
$H_2O = 7150 \times .3915 = 2{,}799$ pounds

Total gas from perfect combustion 69,790

The weight of air required for perfect combustion of 7150 pounds of coal per hour will be:

$7150 \times 8.9537 = 64{,}019$ pounds.

	Pounds
Weight of oxygen in this air = 64,019 × .231 =	14,788
Weight of nitrogen in this air = 64,019 × .769 =	49,231
	64,019

Gases from Raw Materials

The excess air actually used in combustion cannot be calculated at this point owing to the fact that the gases of combustion are contaminated by the gases given off from the raw materials which are calculated as follows:

	Pounds.
Weight of excess air = .257 x 64,019 .... =	16,453
Weight of oxygen in excess air = .231 x 16,543 =	3,800
Weight of nitrogen in excess air = .769 x 16,543 =	12,653
Total air used = 64,019 + 16,543 .... =	80,472

Water Vapor

The air used for combustion will introduce into the kiln a varying amount of water vapor depending upon the temperature and humidity of the inlet air. Under the conditions prevalent in the majority of cement plants, the amount of this water vapor in the air will be sufficient to affect the accuracy of the calculated results.

By the use of a sling psychrometer and a set of tables, the humidity and the weight of water vapor per cubic foot of air may be readily determined. The weight of air is converted to cubic feet of air at the corresponding temperature assuming atmospheric pressure by the formula:

$$\text{Cu. ft. of air} = \frac{\text{Pounds of air}}{.08071} \times \frac{458 + t}{490}$$

$$\text{Lb. water vapor} = \frac{\text{Cu. ft. air at t deg.} \times \text{grains per cu. ft.}}{7000}$$

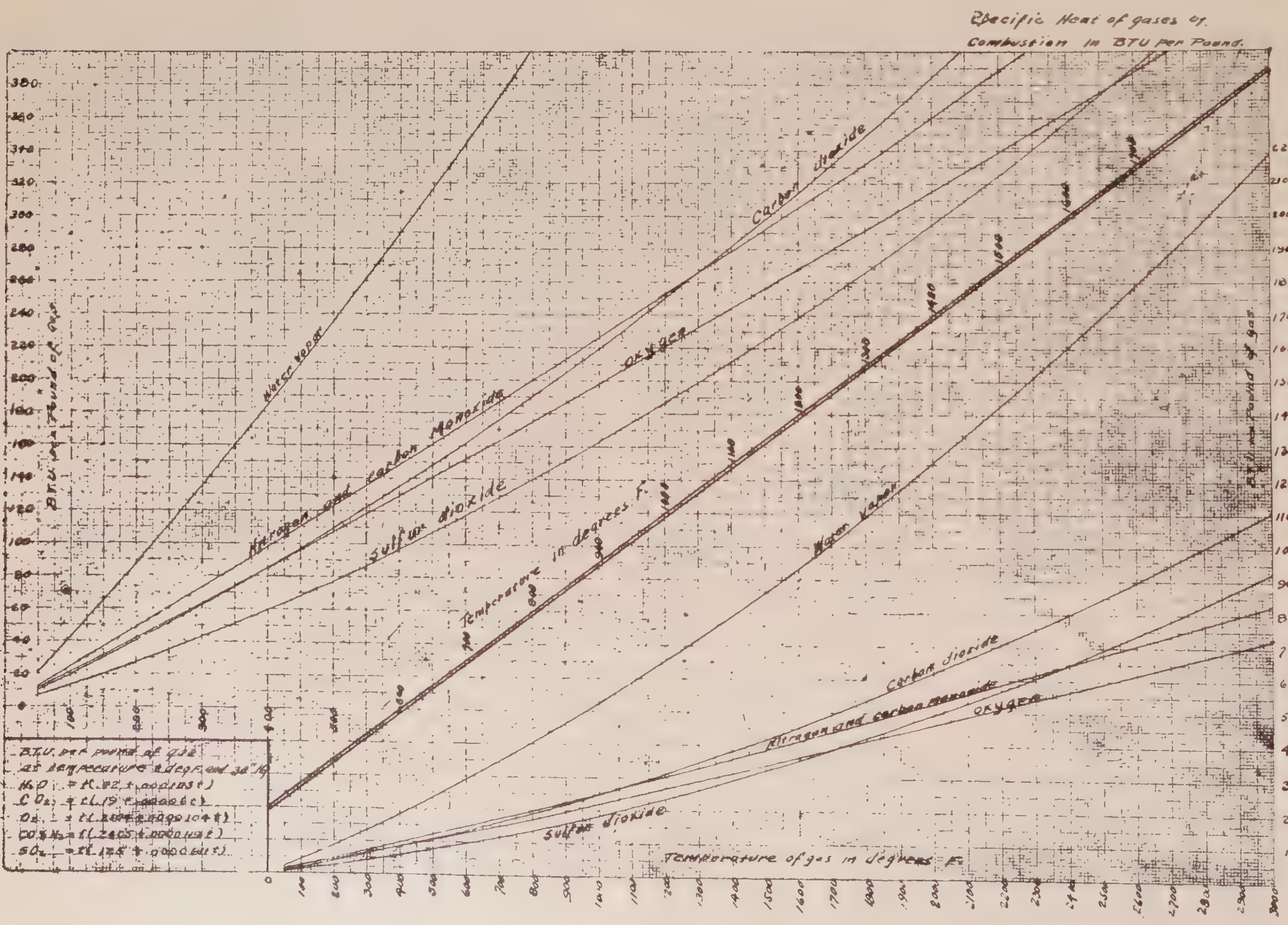
As the air condition during the test was an average temperature of 80 deg. F. and an average humidity of 55 percent, the psychrometic tables will show 6.0 grains of water vapor per cubic foot of air.

$$\text{Cu. ft. of air per hour} = \frac{80{,}472}{.08071} \times \frac{538}{490} = 1{,}094{,}762$$

and the weight of water vapor admitted with the air will be:

$$\text{Lb. of water vapor} = \frac{1{,}094{,}762 \times 6.0}{7{,}000} = 938 \text{ lb. per hr.}$$

	Pounds.
Weight of dry raw mix per bbl of clinker burned =	579
Weight of dry raw mix used per hour = 54.6 x 579 pounds .... =	31,613



Weight of slurry used per hour = $\frac{31,613}{.637}$ = 49,628

Weight of water per hour in slurry = 49,628 — 31,613 = 18,015

Theoretical weight of raw material for one barrel clinker = 565

Weight of raw material converted to clinker = 54.6 x 565 = 30,849

Weight of raw m'ter'l to dust = 31,613 — 30,849 = 764

CO_2 from raw mix to clinker = .3589 x 30,849 = 11,072

CO_2 from raw mix to dust = .1589 x 764 = 121

Combined water in dry mix = .01 x 31,613 = 316

Total CO_2 from mix = 11,072 + 121 = 11,193

Total H_2O from mix = 18,015 + 316 = 18,331

The gases added from the raw mix are carbon dioxide and water. The weight of nitrogen and oxygen in the original gases of combustion is unaffected by the gases from the mix. The excess air in combustion must be calculated from the nitrogen, the oxygen, and the carbon monoxide in the kiln exit gases.

Excess Air

The per cent of air actually used as compared with that required for perfect combustion, with nitrogen, oxygen and carbon monoxide in per cent by volume in the gas, is expressed as follows:

$$\text{Percent air used} = \frac{N_2}{N_2 - 3.782\ (O_2 - \tfrac{1}{2}\,CO)}$$

$$\text{Percent air used} = \frac{74.58}{74.58 - 3.782\ (4.07 - .07/2)} = 125.7$$

The air actually used thus exceeded the air required by the coal for perfect combustion by 25.7 percent.

Total Weight of Gases

Summarizing the total weight of gases per hour from all sources we have:

	Pounds.	
CO_2 and SO_2 from combustion of fuel =	17,632	
CO_2 from the raw material =	11,193	
Total CO_2 =		28,825
O_2 from the excess air =	3,800	3,800
N_2 from the air for combustion =	49,231	
N_2 from the excess air =	12,653	
Total N_2 =		61,884
Total weight of dry gases =		94,509
H_2O from water in slurry =	18,015	
H_2O from combined water in dry mix =	316	
H_2O from combustion of fuel =	2,799	
H_2O from air for combustion =	938	
Total H_2O in gases =		22,068
Total weight of gas per hour =		116,577

Gas Analysis by Weight

The average analysis of the kiln exit gases are converted to analysis by weight as follows:

	Percent by Volume		Weight Per Cu. Ft.	Weight Pounds	Percent by Weight
CO_2	.2128	×	.1234	.026259	.2975
O_2	.0407	×	.08921	.003630	.0411
CO	.0007	×	.07806	.000055	.0006
N_2	.7458	×	.07821	.058329	.6608
				.088273	

A comparison of the calculated gas analysis compared with the average analysis will be:

	Weight of Gas	Calculated Analysis	Actual Analysis by Weight
CO_2	28,825	30.4997	29.75
O_2	3,800	4.0208	4.11
CO			.06
N_2	61,884	65.4795	66.08

The above comparison of the calculated and the average actual gas analysis by weight is very important as it offers a check on the relative weights of coal and raw material used.

The weight of the raw material used can usually be obtained with a fair degree of accuracy by measurement of the cubical contents of the bin or tank. If the slurry is maintained with constant moisture the result should be within the errors of observation of the test. In most plants the ratio of the clinker produced to the weight of raw material has been determined from long time records. If this is not available the clinker may be weighed. The difference between the theoretical weight of raw material required for a barrel of clinker and the actual weight required will be the material lost as dust in the flue gases.

Determining Weight of Coal Used

The weight of fuel used is usually more difficult to determine accurately on short time tests. The levels of the coal in the various bins and the variation in density of the pulverized coal under different conditions will offer opportunities for error in quantity.

When the gas analyses are taken carefully to obtain representative samples of the gas at frequent and regular intervals, the results are more accurate than the usual determination of coal weight. In several tests where a discrepancy occurred between the actual and the calculated analyses, it was found that the analyses could be brought into agreement by correcting the coal weight. The fact that all the constituent gases came into agreement by correction of the fuel weight can only indicate that this weight was in error.

Heat Calculations

The heat per pound of the gases leaving the kilns at an average temperature of 1229 deg. F. is obtained from chart No. 1 and the total heat carried by these gases will be:

	Pounds Per Hour		B.t.u. Per Pound		B.t.u. Per Hour
CO_2	28,825	×	327	=	9,425,775
O_2	3,800	×	274	=	1,041,200
N_2	61,884	×	315	=	19,493,460
H_2O	22,068	×	672	=	14,829,696
	116,577				44,790,131

The total heat per hour in the fuel burned is:

7,150 × 11,965 = 85,549,750 B.t.u.

The total heat in the coal less the heat in the gases leaving the kiln will be the heat absorbed in the kiln for all purposes. This will include the heat absorbed in the process of clinkering, in the latent heat of evaporation of the water, in the heating of the air and fuel to the flame temperature, the loss in the clinker, and in radiation from the shell. Thus:

85,549,750 B.t.u. = total heat in the coal.
44,790,131 B.t.u. = heat in the gases leaving the kiln.

40,759,619 B.t.u. = heat absorbed in the kiln.

The heat lost by the gases in passing through the boilers and economizers should equal the heat absorbed in the generation of steam in the boiler and economizer plus the radiation losses from the flues and boiler setting. The heat in the gases at the economizer exit is then calculated in a similar manner to that for the kiln exit gases.

Economizer Exit Gases

The average analysis of the gases at the economizer exit converted to analysis by weight is:

	by Volume						Analysis by by Weight Percent
CO_2	19.61	×	.1234	=	2.4198	=	27.58
O_2	5.97	×	.08921	=	.5326	=	6.07
CO	.10	×	.07806	=	.0078	=	.09
N_2	74.32	×	.07821	=	5.8125	=	66.26
					8.7727		

The calculation of the excess air from the analysis by weight is:

$$\text{Percent air in gas} = \frac{66.26}{66.26 - 3.329\,(6.07 - .572 \times .09)} = 143.35$$

	Pounds.
The weight of the excess air at the economizer exit = .4335 × 64,019	= 27,752
The weight of the excess air at the kiln exit	= 16,453
The air infiltration in the flues and boilers	= 11,299

The water in the air infiltration is:

$$\frac{11{,}299 \times 538 \times 6}{.08171 \times 490 \times 7000} = 130 \text{ pounds water vapor}$$

	Pounds.
Oxygen in the air infiltration = 11,299 × .231	= 2,610
Nitrogen in the air infiltration = 11,299 × .769	= 8,689

The gas weight leaving the economizers will then be as follows:

	Pounds.	
CO_2 at the kiln exit	28,825	28,825
O_2 at the kiln exit	3,800	
O_2 from air infiltration	2,610	
		6,410
N_2 at the kiln exit	61,884	
N_2 from air infiltration	11,299	
		73,183
Total dry gas		108,418

The total weight of gas at the economizer exit will be:

Total weight of dry gas		108,418
Water vapor at the kiln exit	22,068	
Water vapor from air infiltration	130	
		22,198
Total weight of gases		130,616

The heat carried from the economizers by the gases will then be:

	Pounds of Gas		B.t.u. Per Pound	Total B.t.u. Per Hour
CO_2	28,825	×	76	2,190,700
O_2	6,410	×	76	487,160
N_2	73,183	×	88	6,440,104
H_2O	22,198	×	164	3,640,472
				12,758,436

By subtraction we have:

Heat in gases at kiln exit	44,790,131	B.t.u. per hr.
Heat in gases at econ. exit	12,758,436	"
Heat drop in gases through boilers	32,031,695	"
Heat absorbed in steam	30,112,482	"
Heat loss from radiation	1,919,213	"

Summarizing for a heat balance, we have:

Heat absorbed in kilns 40,759,619 B.t.u. = 47.65 percent
Heat absorbed in boilers 30,112,482 B.t.u. = 35.20 percent
Heat loss from radiation 1,919,213 B.t.u. = 2.24 percent
Heat loss in stack gases 12,758,436 B.t.u. = 14.91 percent

Total heat in fuel 85,549,750 B.t.u. = 100 percent

To obtain the boiler efficiency we must start with the heat in the gases delivered from the kilns to the boilers:

Heat absorbed by boilers 30,112,482 B.t.u. = 67.23 percent
Heat loss from radiation 1,919,213 B.t.u. = 4.28 percent
Heat loss in stack gases 12,758,436 B.t.u. = 28.49 percent

Total heat in gases 44,790,131 B.t.u. = 100 percent

Comparison with Direct Fired Boilers

The following comparison of the thermal efficiency to be expected with modern direct fired boilers and the above figures for waste heat boilers will show that the waste heat boiler may be made to occupy a very favorable position in heat economy:

	Direct Fired Boilers			
	Extreme Economy Large Units Percent	Good Percent	Average Percent	Waste Heat as Above Percent
Heat for				
Unburned fuel loss	.6	3.0	10.0	
Absorption in steam	90.0	78.0	61.0	67.23
Radiation loss	1.3	3.0	4.0	4.28
Stack loss	8.1	16.0	25.0	28.49
	100.0	100.0	100.0	100.00

The thermal efficiency of the waste heat boiler may thus be brought above the average efficiency of the direct fired boilers in modern steam stations and will compare favorably with the highly efficient units in the extremely large stations. It is true that the waste heat boiler may never be brought to the high efficiency of the large units, but it has been brought to a point where it can show as high efficiency as units of similar size with direct firing. It is difficult to predict how much additional thermal efficiency may be economically developed, but with the same grade of technical operating control which has resulted in the recent development in the direct fired boiler, some additional increase may be expected.

In a well designed waste heat plant the largest remaining loss is in the gases leaving the economizers below 400 deg. F. It may be possible to recover a portion of this heat without condensation in the treater chamber and stack, but it will require lagging of the flues. This heat is available at such a low temperature that it may not prove economical to attempt its recovery.

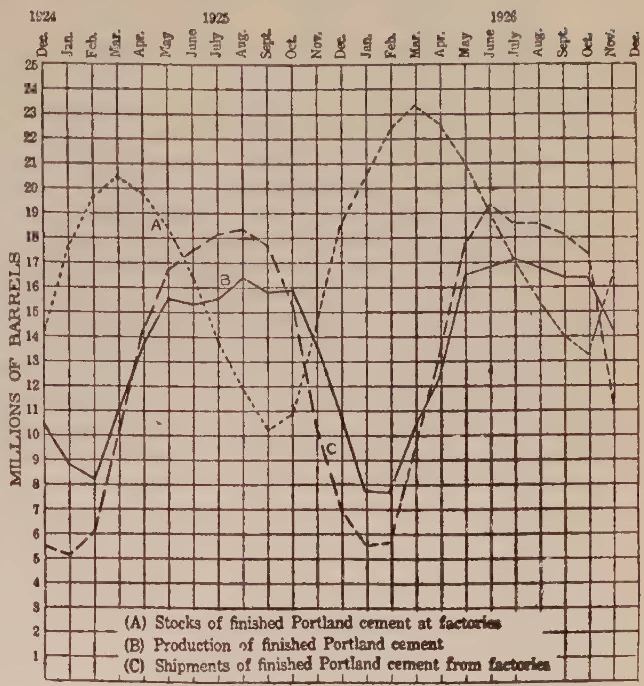
The figures used in the above calculations are not to be considered as representative of the average conditions in the industry, but represent about the extreme practical recovery which may be expected from equipment as developed at the present time. Equipment, fuel and materials vary so much that caution should be exercised in making a direct comparison with results attained at different plants. Such comparisons are apt to be very deceptive unless all factors are considered. Thus the writers wish to call attention to the method proposed for calculating the results rather than the actual figures given above.

At the annual election of officers of the American Society of Mechanical Engineers, Charles M. Schwab was elected president for the current year. Mr. Schwab assumed his new office at the annual meeting, held in New York City early in December. William L. Abbott of Chicago was the retiring president.

Cement Statistics for November

November production of portland cement shows an increase of about 4 per cent and shipments an increase of nearly 11 per cent as compared with November a year ago, according to the Bureau of Mines, Department of Commerce. Portland cement stocks at the end of November, 1926, were almost 22 per cent higher than at the end of the preceding month, and were nearly 12 per cent greater than the stocks at the end of November, 1925.

These statistics are compiled from reports for November, 1926, received direct from all manufacturing plants except two.



Estimated Clinker (Unground Cement) at the Mills at End of Each Month, 1925 and 1926, in Barrels

Figures represent thousands of barrels

	1925	1926
January	7,017	9,074
February	8,497	10,931
March	9,962	12,284
April	9,731	12,934
May	9,053	11,649
June	7,937	10,086
July	6,961	8,515
August	5,640	7,362
September	4,561	*6,095
October	4,086	5,387
November	5,013	......
December	6,469	....

Production, Shipments, and Stocks of Finished Portland Cement, by Months, in 1925 and 1926

Figures represent thousands of barrels

Month	Production		Shipments		Stocks at end of month	
	1925	1926	1925	1926	1925	1926
January	8,856	7,887	5,162	5,674	17,656	20,582
February	8,255	7,731	6,015	5,820	19,689	22,384
March	11,034	10,355	10,279	9,539	20,469	23,200
First quarter	28,145	25,973	21,456	21,033	--------	--------
April	13,807	12,401	14,394	12,961	19,877	22,640
May	15,503	16,472	16,735	17,951	18,440	21,173
June	15,387	16,827	17,501	19,113	16,409	18,900
Second quarter	44,697	45,700	48,630	50,025	--------	--------
July	15,641	17,096	18,131	18,786	13,896	17,210
August	16,419	16,936	18,383	18,536	11,952	15,718
September	15,939	16,571	17,711	18,087	10,247	14,195
Third quarter	47,999	50,603	54,225	55,409	--------	--------
October	15,992	16,596	15,309	17,486	10,979	*13,334
November	13,656	14,193	10,187	11,290	14,534	16,237
December	10,713		6,917	--------	18,515	--------
Fourth quarter	40,361	--------	32,413	--------	--------	--------
	161,202	--------	156,724	--------	--------	--------

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*Revised.

Commercial District	Production—November		Shipments—November		Stocks at end of Nov.		Stocks at end of Oct., 1926*
	1925	1926	1925	1926	1925	1926	
Eastern Pennsylvania, New Jersey, and Maryland	3.457	3,617	2,909	3,356	1,353	2,697	2,437
New York	872	820	609	609	670	896	685
Ohio, Western Pennsylvania, and West Virginia	1,241	1,157	852	1,067	1,904	2,151	2,062
Michigan	988	1,227	585	781	1,318	1,471	1,026
Wisconsin, Illinois, Indiana, and Kentucky	1,941	1,930	1,211	1,143	2,882	2,084	1,296
Virginia, Tennessee, Alabama, and Georgia	1,192	1,290	754	1,233	722	1,124	1,067
Eastern Missouri, Iowa, Minnesota, and South Dakota	1.220	1,310	769	602	2,422	2,317	1,609
Western Missouri, Nebraska, Kansas, and Oklahoma	859	821	818	739	1.559	1,538	1,455
Texas	399	402	356	427	426	381	406
Colorado, Montana, and Utah	95	200	128	156	453	450	406
California	1,099	1,154	1,029	972	529	662	480
Oregon and Washington	293	265	167	205	296	466	405
	13.656	14,193	10,187	11,290	14,534	16,237	13,334

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*Revised.

MEN and MILLS

Notes from the Field

New England Portland Cement and Lime Co. Begins Operation

Lawrence Portland Cement Co. Signs Contract to Take Over Plant and Properties

On Friday, November 19, the first lime kiln was fired at the new plant of the New England Portland Cement and Lime Co., at Thomaston, Maine, starting in operation one of the most modern, low-manufacturing cost lime plants in the United States.

State officials, representatives from the city of Rockland, town of Thomaston, representatives of the Lawrence Portland Cement Co., and building supply dealers from various parts of New England attended the opening and inspected the plant.

Alfred S. Black, president of the company, made the important announcement that the Lawrence Portland Cement Co. had signed a contract for the purchase of the plant and properties of the New England Portland Cement and Lime Co., and on passing of final papers were to construct a modern portland cement plant adjacent to the lime plant. The Lawrence Portland Cement Co. is one of the oldest cement companies and manufacture Dragon Portland Cement. The cement plant at Thomaston will be the only portland cement plant in the New England states.

The completed plant will include a modern cement plant of 3,000 barrels daily capacity, together with a lime unit of four Schaffer semi-automatic shaft kilns with a capacity of 500,000 barrels of burned lump lime per year. The first two of these kilns are completed and in operation.

The mineral deposit from which both lime and cement will be made consists of some 500,000,000 cubic feet of limestone suitable for the manufacture of portland cement and available for open quarry methods of recovery, together with some 650,000,000 cubic feet of stone underground, particularly adapted to recovery by mining methods. All of this stone has been proven both as to quantity and character by diamond drill cores and laboratory analyses.

This company's properties are directly on the seaboard and being approximately 1,000 acres in extent, cover all the known or probable limestone area in the formation that has not been operated at some former time. There are unlimited quantities of marine clay on or directly adjacent to the rock deposit. The company owns more than 20 acres on the Rockland waterfront, making it possible to ship by rail and water. The Maine Central Railroad runs through the properties.

The kilns are of the Schaffer semi-automatic shaft type with an outside diameter of 17 feet, 3 inches, and a height from firing floor to the top of the charging chamber of 53 feet.

The supply of fuel to the kilns is handled in a manner that in some of its features is new to the lime industry.

Crushed coal is dumped from hopper bottom cars through a track hopper and is crushed in the usual way, then conveyed by an incline scraper to a conical pile holding 2,500 tons stored in the open, adjacent to the quarry and kilns.

A standard type of reclaiming machinery in the form of a belt conveyor operating through a tunnel extending under the coal pile carries the coal into a chute which discharges above the quarry floor about 45 feet below the general plant yard level. This chute empties into a hopper from which the ordinary quarry cars are loaded with coal and moved over the quarry tracks and up the incline to the top of the kilns in a manner exactly similar to and on the same transportation system as stone used to charge the kilns.

Between No. 1 and No. 2 kilns a steel bunker extending from the top of the kilns down to a height of about 15 feet above the firing floor is constructed, using the steel kiln sides as two sides of the bunker and with flat plates extending from the center line of one kiln to the center line of the adjacent kiln, tangent to the kiln shells, then forming between the kilns a coal bunker with a capacity of 75 tons.

The lime when discharged from the coolers will be sorted by hand, as this is believed to be the only positive way of assuring proper selection. The most modern methods of barrel handling will be used and a pulverizing department of the latest type will form a part of the plant.

Louisiana Plant Completion Expected Soon

The Louisiana Portland Cement Company plant, representing an investment of nearly $4,000,000, is expected to be completed early this year, according to L. R. Ferguson, manager. Capacity will be about 750,000 tons annually.

Drop Cement as Filipino Government Activity

A group of Filipino capitalists is to take over the government cement enterprise, it is reported. The move is the first and cement takes the leadership in the degovernmentalization of state-owned and operated industries. The price to be paid is about $1,000,000, based on the book value.

The degovernmentalizing of cement manufacture is reported to have been under consideration for some time. Almost every shipment of cement from Japan has been able to undersell local cement.

Giant Portland Cement Company Dividends

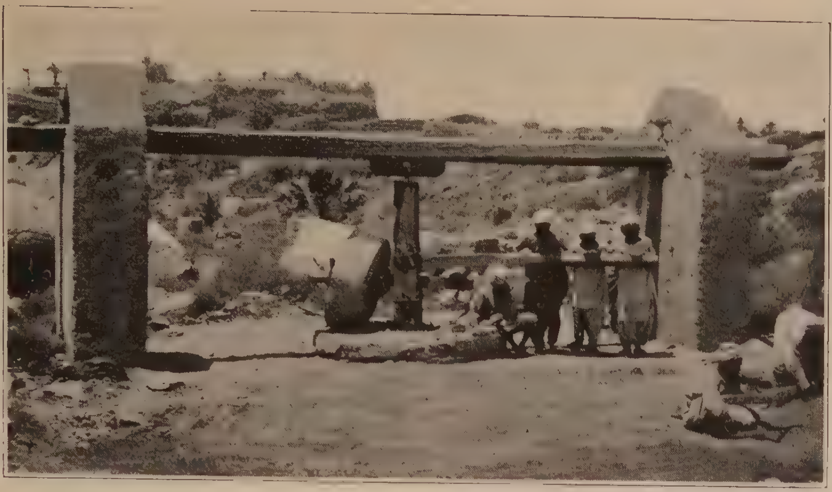
A recent spurt in the Giant Portland Cement Company stock on the Philadelphia Exchange, although not maintained, led to the belief in financial circles that the company's directors will soon put through a plan to discharge the accumulated dividends on the preferred stock. These amount to 19 per cent, or $9.50, the par of the stock being $50.

It is the impression that the bulge in the company's common stock was due to buying based on the belief that with the preferred dividends out of the way, the holders of the junior issue would soon share in a liberal way in the profits. While the company has issued no recent financial statements, reports are that the earnings have been running ahead in satisfactory volume and that the balance for the common stock on the full year's operation will be a substantial one.

Mill Construction Held Up Pending Power Supply

The Missouri Portland Cement Company recently purchased 416 acres about eight miles west of Batesville, Missouri, on the Missouri Pacific Railroad. Construction will begin as soon as arrangements for a supply of electricity have been completed.

It is proposed by the mayor of Batesville and others interested in the location of the plant that the Batesville lighting system be sold to the Arkansas Power and Light Company, which has submitted a proposal for purchase of the local system and has agreed to furnish 10,000 h.p. electrical power by extension of its high voltage transmission system within 12 months.



Earliest methods of cement-making still exist. Here are some Egyptians grinding rock with primitive "grinding machinery" to make a crude cement. The photograph was taken near King Tut's tomb.

Alabama Mill Planning $500,000 Improvements

Announcement is made by the Alabama Portland Cement Company, subsidiary of the International System, that engineering work and plans have been completed for changes in equipment and method of operation involving the early expenditure of approximately $500,000 at the company's plant at North Birmingham. More modern equipment and a change from the dry process of manufacture to the International wet-blending method is provided.

The announcement is also made that hereafter the product will be packed in cotton bags instead of burlap, in order to augment the use of cotton.

Southern Increase Proposal Suspended

Washington, D. C.—The Interstate Commerce Commission has suspended until February 13 an increase proposed by the Chesapeake & Ohio Railway of four cents per 100 pounds on cement, carloads, from Fordwick, Va., to stations on the Tallulah Falls Railway in Georgia and North Carolina.

Southwestern to Add Another Kiln

The Southwestern Portland Cement Company has authorized the making of plans and the selection of equipment to increase the capacity of its mill at Osborn, Ohio. The new equipment installation will raise the present three-kiln capacity of the plant to four kilns.

Cement Industry in State Geologic Report

Completion of a report known as the "Atlas of the Allentown Quadrangle" is announced by the Pennsylvania State Geologic Survey. The report describes the cement industry and its history and the mineral, soil and water resources in the vicinity.

Lawrence Portland Cement Company Safety Rally

The safety council of the Lawrence Portland Cement Company on December 6 held a combined safety and educational rally at an Allentown (Pennsylvania) theater, with David Adams, safety inspector at the plant, in charge. The two speakers of the evening were followed by the showing of a safety film.

Lehigh Shares Sold at Public Sale

The Lehigh Valley Trust Company, Pennsylvania, recently disposed of 644 shares of Lehigh Portland Cement Company stock at from $86 to $87.50 to several different persons at a public sale. This action was in accordance with the will of the former holder, Alexander S. Shimer.

Lehigh Cement Moving

Cement is reported to be continuing to move out of the Lehigh (Pennsylvania) district in comparatively heavy volume. Production continues at a high rate and very little of the finished product is going into storage.

1927 Safety Congress to Be Held in Chicago

For the first time in years the annual convention of the National Safety Congress will be held in a hotel large enough to house under one roof its several thousand delegates, its hundreds of exhibits and its scores of sessions.

The sixteenth annual safety congress will be held at the Stevens Hotel in Chicago from September 26 to 30, inclusive, this year, states an announcement made by W. H. Cameron, managing director of the National Safety Council, following a meeting of its executive committee.

Wisconsin Retailers Discuss Cement Distribution

Although the dealer's stock of cement does assist in moving other lines, it does not carry its share of the overhead, was the consensus of opinion registered at a recent meeting of retailer members of the Lafayette County Club. The frequency of high pressure salesmanship among cement company sales managers was declared to seriously affect the problem of over-production.

Alpha Portland Holds Safety Rally

The regular semi-annual dinner of the Martin's Creek No. 3 plant of the Alpha Portland Cement Company was held at that mill on December 8, and attended by thirty-five members, including members of the safety committee.

A chart prepared by Russell Frame and presented at this meeting indicated that Martin's Creek No. 3 plant has attained an accident reduction percentage during the past year of 91 per cent, placing it at the lead of all Alpha plants.

Universal Employees Secure Group Insurance Policy

The 324 members of the Sunbeam Club of the Universal Portland Cement Co., at Morgan Park Station, Duluth, Minn., have acquired a group life insurance policy, placed with the Prudential Insurance Company of America, under the terms of which they will be protected for $1,000 each. The association will pay the premiums.

North American Cement Corp. Profits Published

The North American Cement Corporation for the 10 months ended October 31 shows net income, before depreciation and depletion, of $1,505,885. Net income was $1,086,374, available for interest and amortization.

Gypsum Workers Attend Company School

More than 500 employees of the Chicago office of the United States Gypsum Company are attending classes conducted by company officials and executives, at which the organization of the firm is taken up, the relation of one department to another, and the place occupied by the company in American industry is discussed.

Study sessions are held weekly at a local hotel under the auspices of the U. S. G. club. At the first of the lecture periods Sewell L. Avery, president of the company, spoke in detail on the development of the gypsum industry in America and the causes that resulted in the formation of the United States Gypsum Company.

Revision of Southern Freight Rates Advised

A complete revision of freight rates on portland cement in southern territory, including the Mississippi Valley, and from points in trunk line and central territories to points in the southern states is recommended by John T. Money, the Interstate Commerce Commission's examiner, in a tentative report made public November 16 in the Southern cement rates cases. Examiner Money's report states that present rates on cement between points in southern territory are a mass of inconsistencies and incongruities and in an exceedingly chaotic condition.

Examiner Money's report recommends that the Commission should prescribe a scale of rates somewhat lower than that proposed by the carriers but higher than that suggested by the shippers. The scale proposed by the carriers is substantially the same for distances beyond 95 miles as the western cement scale III, which applies generally in eastern Nebraska, Kansas and Oklahoma and southwestern Missouri. The shippers contend that the base scale to be applied to southern territory should be the same as western cement scale II, which applies generally in Missouri north of the Missouri River, in Iowa, Wisconsin, the upper peninsula of Michigan, and southern and central Minnesota.

White Cliffs Lime Plant to Resume Operations

The Lime Products Company, of Fordyce, Ark., of which A. B. Banks is president, has begun to operate the White Cliffs plant formerly operated by Krippendorf-Tuttle White Cliffs Products Company, producing agricultural lime, asphalt filler, and technical lime products. Needed repairs were made on machinery and tracks to put the plant into condition for efficient operation. It is rumored that expansion of the plant is being considered for the future in order that the company will be enabled to go into production on a large scale.

Mohawk to Get Two New Buildings

The H. K. Ferguson Company, engineers and builders, of Cleveland has been awarded the contract for the immediate design and erection of two new buildings for the Mohawk Limestone Products Company at Jordanville, New York.

The contract calls for a new building approximately 55 feet by 60 feet and 55 feet high, with structural steel frame. The second building is also to be of structural steel 55 feet by 80 feet, with a yard crane runway approximately 320 feet long, with necessary foundations and a heavy retaining wall.

Tennessee Plant Operation to Start Soon

Work is progressing rapidly on the new Cumberland Portland Cement Company's plant at Cowan, Tennessee. It is probable that production will begin about March 1. It is proposed to manufacture a white Portland cement, using raw materials from a 1,000-acre deposit near the plant site. The entire cost of the plant, limestone and clay deposits and employes' homes, is estimated to be about $1,200,000.

Missouri Portland Attacks Rates on Empty Sacks

The Missouri Portland Cement Company of St. Louis has filed a complaint with the Interstate Commerce Commission attacking present freight rates on empty, used cement bags from stations in Kansas and Missouri back to its mills at Prospect Hill and Sugar Creek, Mo. The cement company requests the Commission to establish maximum reasonable rates for the future.

California Contracts for 100,000 Bbbls. Cement

State Purchasing Agent W. G. McMillin, of California, announces that a contract for approximately 100,000 barrels of cement for the use of the State Harbor Commission and some of the state institutions, has been let to the Henry Cowell Lime & Cement Company of San Francisco. The purchasing agent estimates the work for which this cement has been contracted will cost the state $250,000.

Lehigh Company Quarries Active

The present quarrying activities of the Lehigh Portland Cement Company at Union Bridge, Maryland, include the uncovering of a large area of rock to provide abundant, good quality stone. The present quarries are 1200 feet in length, 600 feet wide and 123 feet in depth.

Find Fifty-Year Supply of Cement in California

Crude cement deposits sufficient to care for highway and skyscraper construction in California for half a century have been discovered near Goshen Junction, Tulare County, Cal., according to a report filed December 9 with C. J. MacMillan, State Corporation Commission. The report accompanies an application of the Valley Portland Cement Company for permission to sell 250 shares of preferred stock at $80 a share, to be distributed among a few stockholders. The permit was granted. The Valley Portland Cement Company is a Nevada corporation operating in several cement fields in that state and in California. It is headed by Howard Throckmorton of Los Angeles.

Magnesite Stucco Rates Alleged Prejudicial

Forty dealers in building materials doing business in Kansas, Missouri, Oklahoma and Texas have requested the Interstate Commerce Commission for a reduction in rates on magnesite stucco from the shipping points of manufacturers and jobbers in Illinois, Iowa and Missouri. The complaint filed with the commission November 6 in the name of the Aitken Lumber Co. of Great Bend, Kansas, names 28 railroads as defendants and alleges that the present rates on magnesite stucco are unjust and unreasonable and unduly prejudicial as compared to the rates on stucco and other plasters to competing dealers. Reparation also is claimed on shipments already moved, measured by the difference between the charges collected and the new rates which the commission may prescribe.

Southwestern's Chemist Addresses Meeting

Mr. R. R. Coghlan, chemist of the Southwestern Portland Cement Company, at a recent meeting of the Columbus Concrete Products Association, addressed the gathering on the chemistry of cement. He commended the services made available to concrete products manufacturers through the Portland Cement Association and urged them to avail themselves of the help of the association.

Local Press Gives Credit to Brunn

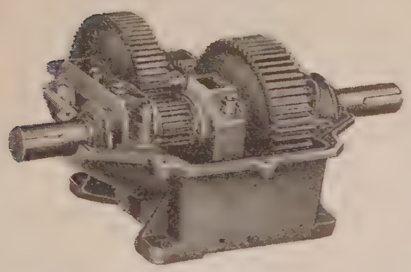
The Dayton (Ohio) local press has credited C. G. Brunn, in charge of the Dayton office of the Wabash Portland Cement Company, with the sale of much of the 110,000 barrels of cement used in building construction in Moraine City, nearby.

Mill Equipment

Palmer-Bee Announces New Speed Reducer

The new speed reducer being marketed by the Palmer-Bee Company, Detroit, Michigan, has some half-dozen major features of interest. The gears are cut from forgings of special analysis steel or from electric steel castings, and pinions from bars or forgings of high carbon steel.

The bushings in all bearings are of phosphor bronze and interchangeable. The addition of a brass pet cock has been made to aid in the determination of the proper oil level. Casing and bearing caps have been ribbed to give added strength at the points of greatest stress. Positive oil-tightness and dustproofing has been secured by an improved, grooved joint, in conjunction with additional bolts connecting the upper and lower halves of the casing. A steel set collar, automatically lubricated, shields gearing from external end thrust.



"Bridging" Eliminated by Use of Compressed Air

A somewhat novel use for compressed air is described by Mr. M. A. Eiben, president of Northern Blower Company, Cleveland, Ohio. When stored cement settles into a tightly packed condition and a bridge of cement forms, a compressed-air pipe is let into the bottom of the bin. The discharge gate is first tightly closed, the air at approximately 100 lb. pressure per square inch is forced into the packed mass. It steadily spreads outward and upward, thus surrounding each grain of cement with a layer of air. In a few moments the surface will heave with eruptions of miniature "volcanoes" of cement dust, restoring the cement to its original condition.

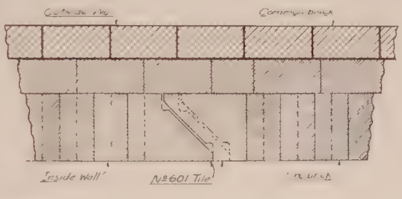
New Type of Schaffer Poidometer Announced

The Schaffer Poidometer Company have recently placed a new type of poidometer on the market, to handle such material as hot clinker, stone, coke and other sharp and abrasive materials. In place of the rubber belt and pulleys this machine is equipped with cold roller steel flights mounted on two strands of 1-inch pitch steel roller chain, which is operated over cut tooth sprockets.

These machines are manufactured in two widths. The 20-inch width has a capacity of 40 tons per hour on such materials as stone and clinker, provided it is crushed to 1½-inch and finer, and the 36-inch width has a capacity of 150 tons per hour on the same material, provided it is crushed to 4 inches and finer.

Efficient Corner Bonding Tile on Market

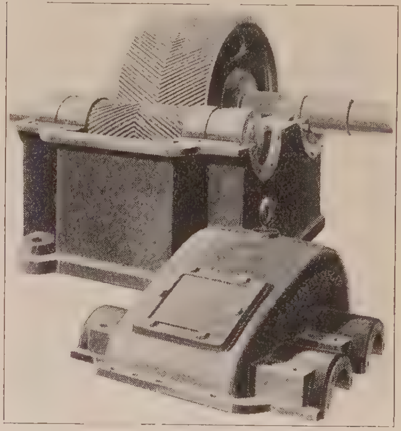
A recently patented corner bonding tile for flues and furnaces for waste heat boilers automatically breaks the joints of each succeeding brick course, eliminating the necessity of using soaps or starting brick. The tile completely forms the corner of the inner lining. The lower expansion joint is concealed and protected from being filled with dust by the lap of the upper tile.



It is being used for securing additional expansion of side walls. The Geo. P. Reintjes Co., Kansas City, are the manufacturers.

James Company Marketing New Speed Reducers

In the new James continuous tooth herringbone speed reducers, a product of the D. O. James Company, Chicago, Illinois, the herringbone gears embody the double helical principle, giving a result similar in appearance to the joining of two single helical gears having opposed heliz angles. Each individual tooth is brought to an apex and has the shape of a completed "V," the tooth being unbroken.



The James Company is now manufacturing reducers, using herringbone gears, for reduction ratios from 2 to 1, to 150 to 1, and able to carry loads of 2 h.p. to 200 h.p.

Gas Cutting Torch Employs Illuminating Gas

The Alexander Milburn Company, Baltimore, Maryland, have just placed on the market a gas cutting torch for use with illuminating and by-product gases.

A bunsen burner, contained within the torch, burns gas which heats the cutting oxygen as it passes through a series of copper coils. The heated and expanded oxygen in conjunction with the illuminating gas gives excellent penetration into the metal, a narrow kerf and sharp, clean edges, with an absence of metallic slag on the underside of the cut.

With the Manufacturers

Industrial Literature

Blower Bulletin

"*Sirocco*" fans and blowers, a product of the *American Blower Company*, Detroit, Michigan, are described and cataloged in *Bulletin No.* 8001, a recent publication. Various views of the parts used in assembly and the devices themselves are shown.

Bulletin 2004 of the *American Blower Company* is devoted to the Type SE Steel Plate Blower, developed for heavy-duty blowing applications.

Ingersoll-Rand Catalog

A new and revised edition of the *Cameron* single-stage, double-suction, volute pump bulletin, Form No. 7059, has been published by the *Ingersoll-Rand Company*, New York City. Each full view is accompanied by a cross-section illustration, followed by specifications and details of assembly.

Pulverization System Catalog

The *Raymond* system of pulverization and air separation, as well as the employment and construction of roller mills, is explained in *Catalog No.* 18 published by the *Raymond Bros. Pulverizer Company*, Chicago. Cross-section outlines of the mills, and installations, are shown, accompanied by numerous photographs.

Brick Leaflet

An unusually attractive leaflet concerning a cement plant that added two months to kiln lining life has been freshly printed by the *Botfield Refractories Company*, and features *Adamant* fire brick cement. A quotation from the superintendent of the plant pictured forms the substance of its appeal.

Meter Publication

A fine work of art in catalogs is the "*Codex*" catalog of industrial thermometers, published by the *C. J. Tagliabue Manufacturing Company*, Brooklyn, New York. Ordering instructions precede the table of contents, followed by an explanation of the *Tag-Hespe* red reading column and the structural features of *Tag* industrial thermometers.

Notes from the Field

Stoker Consolidation

The Illinois Stoker Company, Alton, Illinois, manufacturers of *Illinois* Forced and Natural Draft Chain Grate Stokers announce the recent consolidation of the *K-B Pulverizer Corporation* of New York, manufacturers of the Pulverburner. The Pulverburner is now being manufactured and sold by the Illinois Stoker Company. This acquisition insures to their customers the best of equipment for either stoker or pulverized coal firing.

The New York office of the *Illinois Stoker Company* for both stokers and pulverized fuel equipment will be at 1948 Grand Central Terminal Building.

Timken Changes

Mr. J. H. Ridge has been appointed branch manager of the Pittsburgh branch of the *Timken Roller Bearing Service and Sales Company. Mr. G. G. Weston* has been appointed branch manager of the Omaha branch.

New General Manager

The Wickes Boiler Company has appointed *Henry E. Aldrich* general manager with headquarters at Saginaw, Michigan. *J. Robert Fortune* has been made general sales manager with headquarters in the General Motors Building, Detroit, Michigan.

New "Adamant" Distributors

Adamant fire brick and cement, both manufactured by the Botfield Refractories Co., Philadelphia, is now available in Buffalo, New York, from the Curtis Supply Co., Inc.; in Des Moines, Iowa, from the Waldreth Supply Co., and from the South Side Foundry & Machine Works at Charleston, West Virginia, as well as the Empire Machinery and Supply Company of Norfolk, Virginia.

Allis-Chalmers Changes

Allis-Chalmers Mfg. Co. announces the appointment of *Ernest Smith* as Sales Engineer in the Oruro, Bolivia, office. This is a branch of the company's district office at Santiago, Chile.

Allis-Chalmers Mfg. Co. is opening a branch office in Jackson, Michigan, with *L. F. Berry* as resident representative. This office, located at 512 Reynolds Building, Jackson, is a branch of the company's office in Detroit, which is under the direction of F. S. Schuyler as District Manager.

"Norblo" Representative

The Northern Blower Company, Cleveland, Ohio, manufacturers of equipment for dust-handling, announce the appointment of Mr. Herbert Roush-Kolb as its new sales representative in Detroit.

Link-Belt Office

That its Boston office, formerly located at 49 Federal Street, has left its former habitat for a new home at 1103-1104 Statler Building, on November 1, has been announced by the *Link-Belt Company*, Chicago.

E. C. & M. Representatives

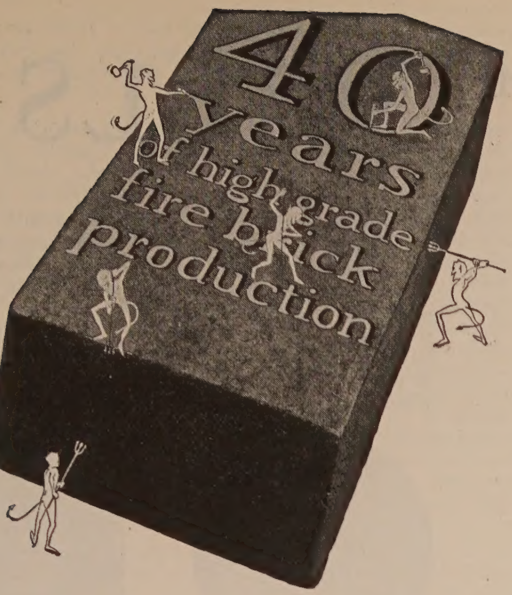
The *Electric Controller & Mfg. Company*, of Cleveland, Ohio, has appointed the *Farr Electric Service, Inc.*, Salt Lake City, Utah, as its representatives.

New Books

"Portland Cement," by Richard K. Meade

A new edition of Meade's "Portland Cement" has been needed for several years. And here it is. On casual inspection it appears a very careful revision of the second edition, published in 1911. On closer inspection it becomes apparent that it is not only a revision, but a new book in many respects. A great deal more space is given over to manufacturing process, and many new illustrations are added to that part of the book. The section on the composition of cement has been brought up to date and includes a survey of the recent studies of the ternary systems involved, and the early findings of the U. S. Bureau of Standards' investigators.

The most important change in the book is, of course, the large amount of manufacturing data added. This makes what was originally a hand book of tests and methods of analysis, a timely hand book of the entire industrial process involved. This change is welcome, for such a book was sadly needed.


40 years of high grade fire brick production

DOWNRIGHT
PRODUCTION
ECONOMY

In fire brick the first cost is the least cost. Liners that melt, spall or crack when you need the kiln most create losses far more serious than the original cost of the brick itself.

That's where the economy of Ashland liners comes in. They pay for themselves many times over in longer life and greater freedom from repair expense or loss of production time.

You are making no costly experiment when you line with the Ashland line. Its various brands have met the test of cement kiln service successfully for more than forty years.

ASHLAND
FIRE BRICK CO.
Incorporated *1886*
ASHLAND, KENTUCKY
Manufacturers Of Sized Brick

SALES AND SERVICE OFFICE
New York
Cleveland
Chicago
Indianapolis
Detroit
Havana, Cuba

Power Transmission

By W. F. SCHAPHORST

A Belt Transmission Formula

The formula that is used probably more than any other in the transmission of power through belts is this one:

$$\text{H. P.} = \frac{(T - t)s}{33{,}000}$$

Where T = tension in lb. on the tight side:
t = tension on the slack side in pounds;
s = speed in feet per minute.

The writer has often wondered why it is that engineers who develop formulas persist in leaving a number in the denominator when it can as easily be placed in the numerator. It is much easier for most of us to multiply than to divide. The process of dividing is generally slower and more vexing. Thus, the above formula may be written in the following form and still be almost as accurate as in the original:

$$\text{H. P.} = .0000303\,(T - t)s$$

Belting a Vertical Shaft

To connect a vertical shaft with one that is horizontal by means of a belt necessitates a so-called "quarter turn drive." Because of the 90 degree turn it is advisable to allow ample space between the pulleys. One well-known rule is: "Multiply the width of the belt in inches by the diameter of the driving pulley in inches; and extract the square root; then multiply by 10." The result, I presume, is the distance between pulley rims in inches. The author does not state. Anyway, my advice is: Of the two above rules, use the one that gives the *largest* result.

The weight of the belt itself is usually a hindrance to a good and easy distance between shaft centers because of the tendency of the belt to drop down away from the pulley on the vertical shaft. For that reason a light belt is advantageous. The lighter the better. Also, a pulley on the vertical shaft having considerable crown is more liable to hold the belt up in position than is a pulley with small crown.

Before resorting to the use of idler pulleys to hold the belt in position on the vertical shaft pulley it is well to do some experimenting by shifting the pulley on the vertical shaft up and down and "trying" various positions. Avoid the idler if possible.

Output of Masonry, Natural, and Puzzolan Cements in 1925

Statistics of hydraulic cements, other than portland cement, in 1925,—in which are grouped masonry, natural, and puzzolan cements,—as compiled by the Bureau of Mines, Department of Commerce, show an increase in quantity of over 23 per cent, and in value of over 27 per cent as compared with the output in 1924.

The output has been expressed in terms of 376-pound barrels to correspond with the statistics of portland cement.

MASONRY, NATURAL, AND PUZZOLAN CEMENT
SHIPPED FROM PLANTS, 1924 AND 1925

	1924			1925		
States	Producing plants	Barrels of 376 lbs.	Value	Producing plants	Barrels of 376 lbs.	Value
Alabama*	1	745,369	$1.147,088	1	939,062	$1,491,333
Illinois	1			1		
Indiana	1			1		
Kansas	1	673,092	859,471	1	812,663	1,060,250
Kentucky	1			1		
Minnesota	2			2		
New York	1			1		
Ohio	1			1		
Pennsylvania	1			1		
	10	1,418,461	$2,006.559	10	1,751,725	$2,551,583

*Puzzolan only.

FACTS FROM THE MILLS

Among Portland Cement Plants the Quigley Refractory Gun has met with instant success for kiln and boiler furnace linings.

The enthusiasm among Cement Plant Superintendents who are using the Quigley Gun is so great that we feel it a privilege to pass this information along to the Cement industry at large.

Among the prominent Cement Manufacturing Companies using the Quigley Gun for Kiln and Boiler Furnace linings are:

Alpha Portland Cement Co., Martins Creek, Penna.
Cuban Portland Cement Co., Mariel, Cuba.
International Portland Cement Co., Spokane Wash.
Lawrence Portland Cement Co., Siegfried, Penna.
Lehigh Portland Cement Co., Chapman, Penna.
Northwestern Portland Cement Co., Mason City, Ia.
Superior Portland Cement Co., Concrete, Wash.
Southwestern Portland Cement Co., Victorville, Calif.
Southwestern Portland Cement Co., El Paso, Texas.

The Quigley Refractory Gun is used among Cement Plants for patching—

Boiler Walls	*Kiln Linings*
Boiler Arches	*Hood Linings*
Boiler Baffles	*Kiln Nose Rings*

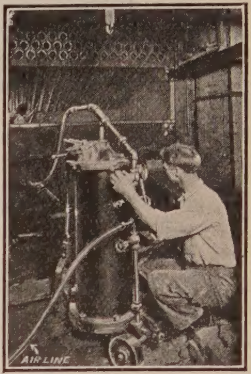
This work is frequently done while linings are hot so that only brief shutdowns are necessary.

PATCHES HOT ZONES

One of our field service men recently reported as follows:

> "Do not know whether you are familiar with clinkering kilns such as are used in burning Portland Cement. I know of one kind and am under the impression that these kilns are standard construction throughout the entire industry.
>
> "These kilns are steel cylinders lined with about 12" of fire brick circle shapes. The outside diameter of these kilns ranges from 8 to 12′. The kiln supported on rollers sets at a pitch of about 3° and it turns about 8 to 10 revolutions per minute by means of a gear drive about midway in its length. The raw material is fed in at the back end and the kiln is fired with pulverized coal at its discharge end. The discharge end of the kiln is sealed with a hood which laps over the end of the kiln on its entire circumference about 12". This hood is lined with fire brick and has a lining about 12 to 15" in thickness. The hot part of a cement clinkering kiln extends back from the discharge end for about 25′. The very hottest part of the kiln lining is about 15′ from the discharge end of the kiln and this is the area where greatest wear occurs and where it is frequently necessary to patch. Our Gun will do this patching in very satisfactory shape by putting on enough pipe at the nozzle of the hose to reach the desired spot. The patching operation is carried out by simply cutting off the fuel supply and stopping the kiln from turning temporarily, with the area to be patched on the bottom of the circle. With the fuel turned off the temperature of the hot zone to be patched would be approximately 2000°. As soon as the patching operation is finished the kiln can be started immediately so there is very little interruption to the operation of the kiln if the desired amount of material for the work in hand has been prepared in advance. You need not hesitate to recommend the Gun to anyone for this work. It is no trouble to keep the pipe nozzle clean passing through this hot temperature if care is taken in the selection of the material so that there would be no possible chance of clogging the end of the hoze nozzle."

Spraying Hytempite Mixture with Quigley Refractory Gun



Above:- Repairing Boiler Baffles.

On the Left:- Patching Furnace Walls and Arches

And again at another plant:

> "I had very good luck in my demonstration of the Gun shipped to . . . . Portland Cement Co. We faced a side wall and a flat arch on one of their Stirling boilers having a Green chain-grate stoker. The flat arch was badly spalled and in chipping off glaze from face of remaining tile it left the face of the wall very rough—a good combination to shoot against but it took in some places nearly three inches to even up the face. After putting on two gun loads on the arch which contained about 50 square feet we took a smoothing trowel and levelled the material that had been placed. You will appreciate that this smoothing operation helps a lot in getting a nice even face at the finish. I did a thing on the side wall that I was very anxious to observe. This side wall had a clincker glaze that was as hard as iron and it would have taken a man 6 or 8 hours to have chipped this face by hand, the total area being about 30 square feet. I had them use an air hammer with a star faced drill and what we did to that glaze in an hour would have made your heart glad. We used 70 pounds air on this hammer and careful observation showed that it did not hurt the wall a particle. We then had a surface that was rough and ideal for the Hytempite Ganisand surface. We used HYTEMPITE with Ganisand in the proportions 1¼ parts Ganisand to 1 part Hytempite by weight. Shot about 1,000 pounds of material in 2½ hours. Air pressure ran from 75 to 80 pounds.
>
> After finishing the work on the boiler we filled the Gun and wheeled it to the Kiln room to patch a hot spot on one of the clinker kilns. The place to be patched in the kiln lining was about 10 feet from the discharge end. We used one inch pipe sixteen feet long as a nozzle. When we were ready to operate they shut off the fuel supply from the kiln and stopped its rotation so that the zone to be patched would be well toward the bottom of the circle and free from any cement clinkers. As you probably know the discharge end of these clinkering kilns is sealed with a brick lined hood.

Three peep holes in this hood afforded ample opportunity to observe any patching operation and we simply put the nozzle through one of these peep holes.

Just as soon as the pipe nozzle had been put through the hood lining I turned on the air at the top valve of the Gun. As soon as the pipe nozzle reached the point to be patched I opened the valve on the piston. We shot one half of the contents of the Gun in five minutes or less. I was careful to keep plenty of air running through the hose line and the instant I got the signal to stop I immediately closed the valve on the piston and kicked open the relief cock at the bottom so that the material would stop flowing instantly. The air through the hose line of course was not cut off until the pipe had been withdrawn from the hood. Examination of the pipe nozzle, after the patching operation was completed, showed it absolutely clean and there had been no tendency for the material to "make up" on the inside of the pipe. The temperature of the Kiln during the patching operation was about 2500° F. We used a mixture same as on the boiler. The Kiln was stopped less than ten minutes for the patching operation.

"The day I demonstrated the Refractory Gun at . . . . . Portland Cement Plant at . . . . . . I patched one of their Kilns in the hot zone, above described and they have told me since that the patch held in good shape and that they did not have to resort to further patching on that particular kiln. The day I was at this plant I also used the Gun to patch one of their hood linings. This lining was badly cupped out in the center and we only shot one gun load more with the idea of seeing whether the patching material would stick satisfactorily to the red hot lining. These hoods have a truck supported on a short section of ordinary railroad track and we simply moved the hoods back about 18" giving us just enough room to get the hoze nozzle to the desired position for placing the material on the wall.

I consider it would be very excellent practice when these hoods are newly lined to face them with about ¼" of plastic refractory material. Then from time to time before they cut too badly, keep replacing the material which has been worn away. In practically every case after the hood has gone into service it would be necessary to do this patching on a red hot wall.

Nearly all Portland Cement Plants have waste heat boilers and as these boilers operate on induced draft it is very essential that their baffles be kept tight to insure efficient operation. The Gun will therefore serve a very useful purpose for baffle facing.

At the above plant I used a mixture of 125 pounds ground brick to 100 pounds HYTEMPITE. I would recommend No. 4 GANISAND as the best aggregate for any patching work around a cement plant.

Read what the Sup't of a large Cement Plant writes to a fellow Sup't of another plant:—

> Dear . . . . . .
>
> I am in receipt of your letter dated August 10th regarding Refractory Gun, which Mr. . . . . was telling you about and will say briefly that I believe it to be *the best investment in the way of tools that we have made for a long time.* I am enclosing a pamphlet, which describes the machine and the work it does very well.
>
> We ordered this principally to try patching small hot spots in kiln linings and bad places in kiln nose rings, and while we have not had a very good opportunity to try this machine on patching hot spots, we have had very good success in patching the nose rings and in fact, we built up a complete ring on our No. 1 kiln which we had been running several days without brick.
>
> *We built up the complete new ring without stopping the kiln* and this has now been in use over two weeks. As a matter of fact, I believe *the Gun has already paid for itself.* We have also used it on a couple of small jobs in repairing the fire boxes of our kiln room boilers.
>
> With kindest personal regards, I remain
>
> Yours very truly
>
> . . . . .Sup't.

(italics ours)

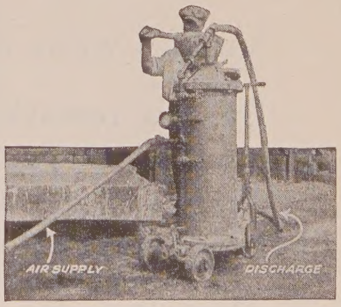
And the General Sup't of a Cement Plant on the Pacific Coast writes our local agent as follows:

> "In reply to your letter of August 27th in regard to the work we have done with the Quigley Gun:
>
> "About six weeks ago we had a portion of lining drop out in one of our kilns. The shell was exposed for an area of about 12" x 18". We successfully patched this with the Refractory Gun. The lost time on the kiln was about two hours. If the kiln had been shut down to put in a new brick lining we would have lost at least eighteen hours. This patch has been in continuous service since it was put in, as far as we can determine at this time, is in as good condition as the remainder of the lining.
>
> **"There is no question in our mind that considerable economy can be effected in operation by patching kilns by this method."**
>
> Yours very truly,
>
> . . . . . . .Gen'l Sup't.

Mix the refractory material with HYTEMPITE in a mortar box close to the GUN if possible.

With this Gun you can

FILL CRACKS OR HOLES
RESTORE A BURNED OUT WALL
FILL GAPS IN WALLS OR ARCHES
RE-SURFACE OLD WALLS
REPAIR LEAKY BAFFLES
BUILD NEW BAFFLES
SURFACE NEW WALLS
and apply
PORTLAND CEMENT, STUCCO, PAINT, WHITEWASH, ETC.



Filling the GUN with plastic mixture

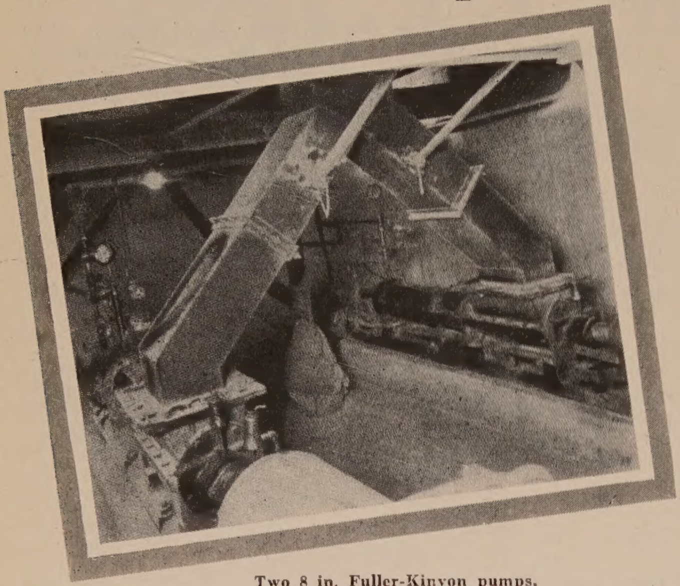
Quigley Furnace Specialties Co., Inc.

26 Cortlandt Street **New York**

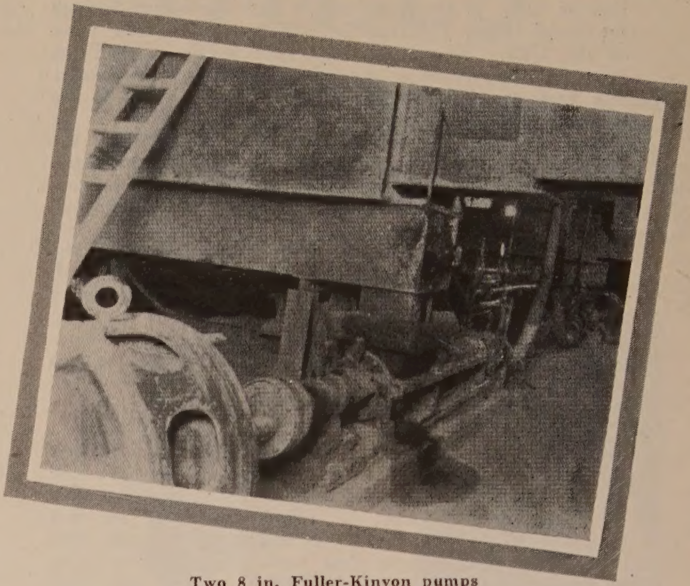
MANUFACTURERS OF HYTEMPITE AND QUIGLEY REFRACTORY GUN

Distributors and Service in Every Industrial Center

A Most Important Contribution to



Two 8 in. Fuller-Kinyon pumps, each direct connected to 150 h.p. motor. These pumps deliver the output of 9 tube mills. One pump serves as standby unit.



Two 8 in. Fuller-Kinyon pumps each direct connected to 125 h.p. motor. This unit is located in basement of packhouse serving 24 silos.

ONE of the most important contributions to the progress of the cement industry since the invention of the Rotary Kiln, has been the development and perfection of the Fuller-Kinyon Conveying System for all pulverized materials.

A typical instance of the value of this system in the modern plant of today is exemplified by the installation at the Lawrence Portland Cement Co. at Siegfried, Pa.

Various views of this installation are shown on this and the opposite page.

By this remarkable system it is not only possible to withdraw material from any silo and convey it to the packing bins, but it is also possible to withdraw from any silo and distribute the product to any one or all the 24 silos during the hours when the packing house is not running.

This entire conveying system was designed and installed by

FULLER COMPANY
Catasauqua, Penna., U. S. A.

FULLER-KINYON System for